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GARBAGE CREMATING FURNACE.

The matter of cleaning the streets of New York and disposing of the collected refuse is still so prominently before the public that we offer no apology for presenting to our readers an illustration and description of another cremating furnace, which operates on a different principle from any of those that have been presented in our columns the past few months.

It appears that about a million loads, or 750,000 tons, of ashes, street sweepings, and garbage were collected in this city last year and thrown overboard, and the amount is annually increasing.

Not only does this method of disposing of the city refuse seriously injure the harbor and neighboring beaches, but it involves an inexcusable waste of material; hence it is evident that other methods must be adopted, and of these none appears to us so practical as cremation, which in this connection means the destruction of a fruitful source of disease, the conversion of a waste material to a valuable commodity, and the consequent annual saving to the city of thousands of dollars.

The advantages of cremation of city refuse have been fully demonstrated in several small towns in England and on the Continent, though the cremating plants there used are costly and of very limited capacity; but the most ardent advocates of cremation here have doubted the practicability of daily cremating 2,000 tons of refuse, which is the average amount collected in this city.

The city produces per annum about 800,000 loads of ashes, 225,000 loads of street sweepings, and 20,000 loads of garbage; but the ashes are so contaminated with garbage that they are unfit for any economic purposes. Were the garbage kept free from the ashes the amount of the former would be increased by about 25,000 loads. But this separation of the two is thought by the Board of Health to be practically impossible, and certainly no legislation to this effect can be enforced without great difficulty and constant and expensive legal proceedings.

It is clear, then, that for the first year or two, or until the citizens have learned to keep separate receptacles for the ashes and garbage, the 800,000 loads of ashes must be screened to reduce the garbage in it to about 2 per cent, or the amount that can be rendered harmless by the alkalies in the ashes, and the separated garbage cremated, or that the whole amount of ashes and garbage must be subjected to the action of fire.

The street sweepings can be used without any intermediate treatment for filling low lands, and the treated ashes are as valuable for such purpose as the best gravel.

In the suburbs of small towns isolated places can be found for the erection of cremation furnaces of any design, and they can be operated there without causing complaint; but such locations are available about large cities only at such distances that the hauling of the refuse to them would be practically impossible.

In such isolated places even cupola or blast furnaces for cremating may be unobjectionably operated, although they cannot consume their offensive steam and gases; for as the charge in such furnaces always burns from the bottom, the steam and gases from the superincumbent burning and drying mass escape into the air undecomposed, and with concentrated offense. Hence such furnaces would not serve in the neighborhood of crowded cities.

It is indispensable, then, if the cremation process be adopted, that an inexpensive furnace of almost unlimited capacity must be devised, capable of working continuously and with great rapidity, and of consuming or decomposing the steam and gases that are generated in the process.

A furnace apparently fulfilling these conditions is shown in the accompanying illustration. It consists of a brick lined cylinder, 60 feet long or thereabouts, and 6 feet in diameter, set at an inclination of about half an inch to the foot, on anti-friction rolls, and revolved by worm and wheel. At the feed end of the cylinder is a small fireplace that is used only for the ignition of the pulverized fuel, which is the principal agent in this work, and for which the inventor of this furnace holds the only United States patents. At the delivery end of the cylinder is shown a receiving chamber or pit (the parts being broken away for this purpose), into which the dried material falls, and whence it is continuously removed by a bucket elevator.

Just beyond this pit, in the base of the smokestack, is the gas mingling and combustion chamber, in which the escaping steam and gases are decomposed and thereby rendered inoffensive.

The operation of the furnace is as follows: The fire is urged in the first fireplace until the latter is hot enough to instantly ignite the pulverized coal which is injected through it by the pulverizer or fan, as shown in the engraving. The jet of burning pulverized coal entering the cylinder quickly heats it throughout to a white heat. At the same time the fire on the grate in the gas combustion chamber has brought the walls and perforated dome thereof to a white heat.

The cylinder is then put in motion at the rate of from two to ten revolutions a minute, and the garbage and ashes, separately or together, are dumped into it from the carts.

The material, as it passes through the cylinder, is exposed to the direct contact of the intense flame and to the direct radiation from the hot brick lining of the cylinder for as long a period as may be desired, this depending upon the speed of the cylinder.

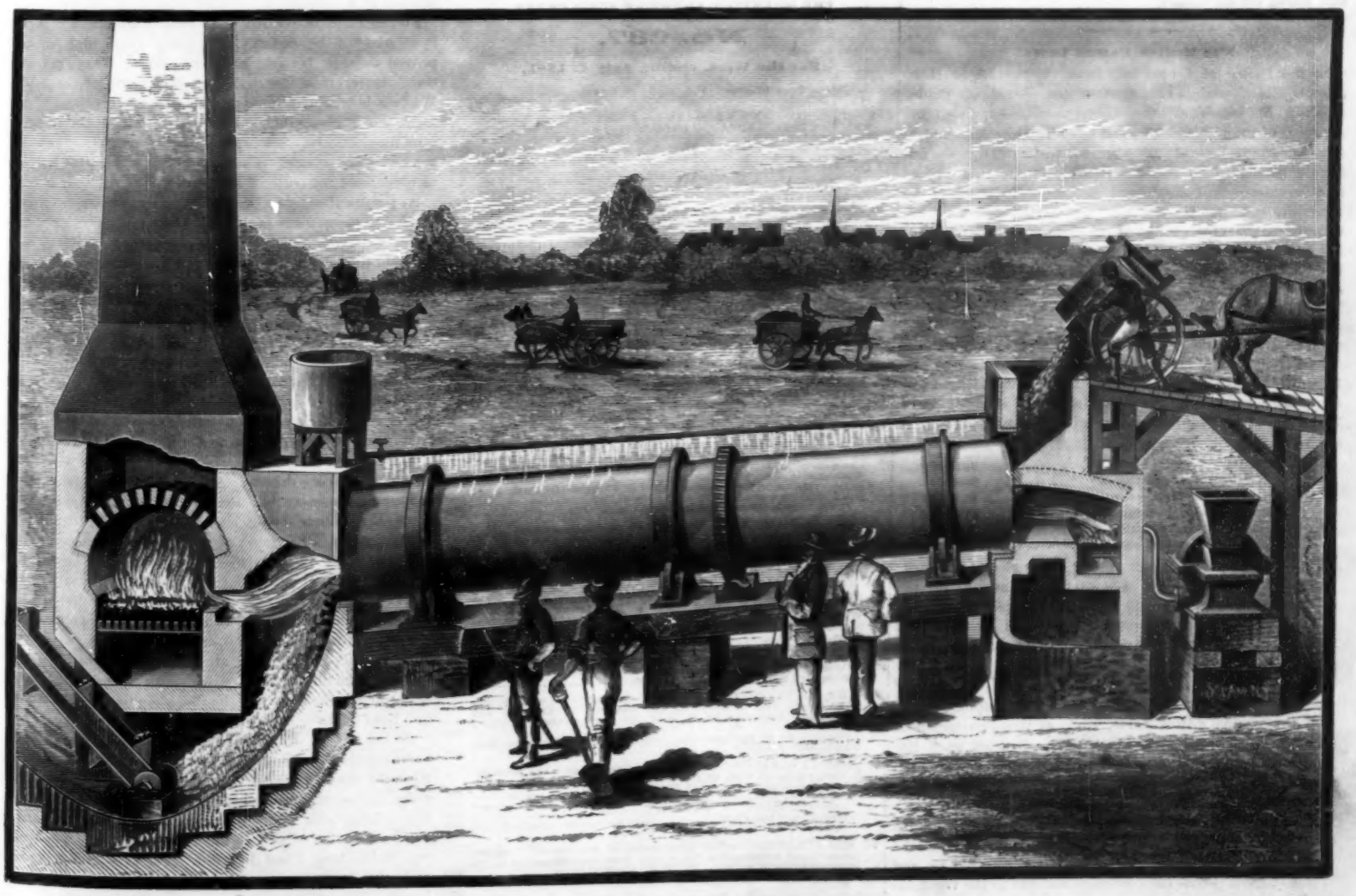
At a speed of about five revolutions a minute the furnace will dry the garbage to the best condition for a fertilizer, while at a speed of two revolutions a minute for the furnace the garbage will be reduced to ashes. The speed is regulated at will by the use of cone pulleys on the countershafts.

The enormous volume of steam and gases generated in the process move forward into the gas combustion chamber, and are there decomposed and burned, the perforated dome retaining them sufficiently long for this purpose.

There escapes then through the dome an intense white flame of sufficient volume to generate steam for all the purposes of the work; not the slightest offensive odor escaping.

A drip pipe discharges a constant spray of water on the cylinder to prevent the expansion thereof, so that the brick lining shall not become loose.

The illustration shows the smokestack constructed of



STORER'S GARBAGE CREMATING FURNACE.

brick above the gas consuming chamber; this construction is preferable for furnaces erected on land; but for those on barges an iron stack is better.

One cylinder, 60 feet long and 6 feet in diameter, will reduce to ashes each day the daily production of garbage in New York, or over 250 loads per diem, and the cost of it, complete with all its auxiliary parts and the engine to run it, will not exceed $12,000.

Two smaller furnaces on barges—one for the North and one for the East River—would dispose of all the city garbage, even if the garbage and ashes were separated, at a cost of plant not exceeding $25,000; and a still smaller one, erected on a barge, could be used for cremating dead animals, condemned meat, mattresses and clothing from emigrant ships and hospitals, etc., and could easily be removed about the harbor to any places where its services were required.

This furnace and the application of pulverized fuel, by which alone it could be operated, are covered by many patents that are controlled by the inventor.

For further particulars address Jacob J. Storer, Post Office box 773, New York.

Magnetic Separation of Iron Sand.

One of the American contributions for the Electrical Exhibition at Paris is a modification of Mr. Edison's magnetic separator for the treatment of iron sand found in large quantities on the south shore of Long Island and in other localities on sea coasts. According to Mr. Batchelor's statement to the *Evening Post* the Long Island sand contains 26 per cent of the finest iron known. Innumerable attempts have been made to separate the sand, and magnetic plates have been used before, but with no success on account of the presence of what is known as titanite iron, a substance which spoils iron. Edison discovered that titanite iron was less magnetic than the pure iron particles, and constructed his separator with that fact in view. The sand falls a distance of four feet in a thin stream from a slit in a V-shaped box holding about a ton. Under this box is a receiver divided into two compartments, the dividing partition being placed nearly under the slit in the sand reservoir and parallel to it. If no magnet is brought into play the sand all falls into one side of the box; but when a powerful magnet is brought near enough to act upon the falling shower, the pure iron particles are deflected in their fall and fly on the other side of the partition. The particles of titanite of iron are not attracted equally with the iron and are not deflected sufficiently to fall into the compartment with the pure iron. A company has been formed for the extraction of iron from Long Island sand, and is now at work with its first machine at Quogue, near Moriches, on the Great South Bay. This machine, which cost $700 to make, is managed by one boy, who keeps six men and two carts busy bringing sand for his hopper. It treats one hundred tons of sand a day, producing about twenty tons of pure iron, costing one dollar a ton to produce and selling for six dollars.

The British Patent Laws.

In the House of Commons, June 15, the Right Hon. Joseph Chamberlain, President of the Board of Trade, speaking on behalf of the Government, expressed his approval of the principle of a bill introduced by Mr. Anderson (Advanced Liberal), member for Glasgow, for amending the patent laws in the sense of a large reduction in fees and the extension of the time of patents, in imitation of the American system. He said the Government would be glad to legislate upon the subject at the earliest possible moment, but it would be impossible to do so at this session of Parliament. All the speakers on the subject dwelt upon the effect of the American patent system in fostering inventions.

The Increasing Cost of Paupers and Criminals.

The California Legislature recently published a report prepared by Chancellor Hartson, of Napa, Chairman of the Committee on Prisons, which contain some startling statistics. The cost of maintaining criminals and paupers is shown as follows:

1850—Population of United States	23,191,876
Criminals and paupers annually	$2,954,806
1860—Population of United States	31,443,321
Criminals and paupers annually	$4,445,143
1870—Population of United States	38,558,374
Criminals and paupers annually	$10,930,429

It is calculated that the census for 1880, when completed, will show an outlay of over $20,000,000 per annum for the cost of maintaining criminals and infirm people. This does not include the enormous outlay occasioned by the arrest and trial of criminals, but simply to their maintenance in prison.

PROFESSOR CHARLES E. MONROE, of Annapolis, states that the ordinary fruit acids, such as those contained in apples, tomatoes, rhubarb, lemons, etc., all acted upon tin. Some cider which he examined, and which had been stored in a tin fountain, contained one hundred and seventeen milligrammes of metallic tin to the liter in solution. One case was given where persons eating fruit preserved in tin cans were made violently sick, and tin only was found in the fruit. Corrosion of tin pipe by water was referred to, and it was suggested that the corrosion was due to the vegetable acids in the water.

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NEW YORK, SATURDAY, JULY 2, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 287,

For the Week ending July 2, 1881.

Price 10 cents. For sale by all newsdealers.

BOILER EXPLOSION NOTES.

The engravings of the boiler explosion at Messrs. Gaffney & Co.'s works, Philadelphia, not being ready, we are obliged to postpone them, together with our report, until our next issue.

We made a brief allusion last week to the peculiar finding of the coroner's jury in the above case. The explosion, it will be remembered, took place June 1st; the boiler was one of a nest of three, of cylindrical form, placed side by side, each 30 feet long and 36 inches diameter, with flat cast iron heads of the usual construction.

The jury found that the explosion was due to the improper use of cast iron in the flat head of the boiler; they also considered that the Hartford Boiler Inspection and Insurance Company was especially censurable for the incompetence and negligence of its agents who inspected and certified to the safety of the boiler; and they urgently recommended that the proper authorities take measures to prevent the recurrence of so terrible a disaster.

On the list of the jurors we find the names of J. B. Fontaine, of Fontaine, Abbott & Co., machinists; N. W. Williams, President of the Keystone Council, engineer; Samuel R. Marshall, formerly of the Wilkesbarre, Pa., Machine Works; J. Shield Wilson, Superintendent of Neafie & Levy's Penn Boiler Works, Kensington; Arthur Orr, of the firm of Orr, Hess & Co., machinists; and J. W. Nystrom, civil engineer.

We shall examine the subject more fully hereafter, and will now only remark that the facts, so far as gathered by us, strongly indicate that the jury rendered an erroneous verdict, and did not avail themselves of the means at their hands to verify practically the correctness of their conclusions. This is the more to be wondered at, because the gentlemen composing the jury were more than ordinarily qualified to make a searching investigation, and place before the public a full and correct explanation of the causes of the disaster. Any reliable information thus disclosed would be of importance to the "proper authorities" and to steam users in general.

The jury assign no reasons and point to no facts to warrant their verdict. From all the information we can gather it seems pretty certain that the explosion was due to an overpressure of steam, perhaps caused by inoperative safety valves and closing of the steam stop valves leading to the other boilers and to the dye works. It is, we believe, undisputed that most of the stop valves examined after the explosion were found to be closed.

Here were three boilers, all substantially alike, all having flat cast iron heads, all recently inspected and certified as safe. One of them, the newer and better boiler, explodes; the other two remain in their places intact and as capable, apparently, of useful service as ever. The jury had the opportunity of submitting the remaining boilers to a thorough test, and of determining on the spot, in the most convincing manner, whether the inspectors whom they complain of had really been remiss in their duty, and whether the jury's notion that flat cast iron heads are unsafe, was really correct. The omission of so obvious a duty detracts greatly from the value of the jury's finding, and makes it look as if they simply jumped at a conclusion.

Flat cast iron boiler heads are used on hundreds of boilers in all parts of the country, and many years of trial have proved them to be safe and serviceable. They generally stand better than the wrought iron parts of the boiler. While it is true that the concave cast head is the stronger form, and is preferable, still it was absurd for the Philadelphia jury to alarm their neighbors by proclaiming that all flat heads are unsafe. They should first have tested and demonstrated the truth of the matter.

As for the Hartford Company it has rendered invaluable service to steam users in the past; its agents and inspectors enjoy the reputation of being competent, reliable men, unlikely to make gross blunders in their inspections or certificates; and in the absence of the practical tests which the jurors might have made, their censure is of little account.

On the 10th of June another disastrous boiler explosion took place at Pottsville, Pa., in the large rolling mill of Atkins Brothers. Three persons were killed and six or more scalded. The exploded boiler was of cylindrical form, 26½ feet long, 30 inches diameter, with a flat cast iron head. Thirty-eight other boilers of similar pattern are used in this establishment, and all unite to form one general steam system, by which the blowers, the rolls, and other machinery of the concern are driven. All the boilers are heated by the products of combustion that rise from the puddling furnaces; the boilers being suspended over the furnaces by arched girders. Each end of each boiler is suspended by hook and staple to the girder. The exploded boiler broke completely in two at a point five or six feet distant from its front end, where the products of combustion first impinge upon the boilers, and where there are the greatest alternations of temperature, due to the opening and closing of the puddling furnace doors. We are preparing engravings and a full report on this occurrence, which we shall shortly publish. According to the theory of the Philadelphia jury the flat cast iron head ought to have blown out—but it did not.

On the 12th of June the boiler of the large and powerful wrecking steamer, B. & J. Baker, of Norfolk, Va., exploded when the vessel was near Cape Henly. Three persons were killed and several badly injured. The boiler was of cylindrical form, with return tubes, containing two tubular furnaces, the tubes of steel 28 inches in diameter. The boiler was 16 feet long, 7 feet diameter. The explosion is believed to be due to corrosion of one of the steel tubes which collapsed. We are preparing a report with engravings which will soon be published.

THE PRESERVATION OF EGGS.

The question, "How can eggs be preserved for market?" just now engages the attention of many of our readers. The following will prove of timely interest to many.

In the common "liming" process a tight barrel is half filled with cold water, into which is stirred slaked lime and salt in the proportion of about one-half pound each for every pail or bucket of water. Some dealers use no salt, and others add a small quantity of niter—one quarter pound to the half barrel of pickle. Into this the eggs, which must be perfectly fresh and sound, are let down with a dish, when they settle to the bottom, small end down. The eggs displace the liquid, so that when the barrel is full of eggs it is also full of the pickle. Eggs thus pickled, if kept in a cool place, will ordinarily keep good for several months. Long storage in this liquid, however, is apt to make the shells brittle and impart a limy taste to their contents. This may be in a great measure avoided by anointing the egg all over with lard before putting in the pickle. Eggs thus prepared are said to keep perfectly for six months or more when stored in a cool cellar.

A much better method of storing eggs is the following: Having selected perfectly fresh eggs, put them, a dozen or more at a time, into a small willow basket, and immerse this for five seconds in boiling water containing about five pounds of common brown sugar per gallon of water. Place the eggs immediately after on trays to dry. The scalding water causes the formation of a thin skin of hard albumen next the inner surface of the shell, the sugar effectually closing all the pores of the latter.

The cool eggs are then packed, small end down, in an intimate mixture of one measure of good charcoal, finely powdered, and two measures of dry bran. Eggs thus stored have been found perfectly fresh and unaltered after six months.

A French authority gives the following: Melt four ounces of clear beeswax in a porcelain dish over a gentle fire and stir in eight ounces of olive oil. Let the resulting solution of wax in oil cool somewhat, then dip the fresh eggs one by one into it so as to coat every part of the shell. A momentary dip is sufficient, all excess of the mixture being wiped off with a cotton cloth. The oil is absorbed in the shell, the wax hermetically closing all the pores. It is claimed that eggs thus treated and packed away in powdered charcoal in a cool place have been found after two years as fresh and palatable as when newly laid.

Paraffine, which melts to a thin liquid at a temperature below the boiling of water, and has the advantage of being odorless, tasteless, harmless, and cheap, can be advantageously substituted for the wax and oil, and used in a similar manner.

Thus coated and put into the lime pickle the eggs may be safely stored for many months; in charcoal, under favorable circumstances, for a year or more.

Dry salt is frequently recommended as a good preservative packing for stored eggs, but practical experience has shown that salt alone is but little better than dry bran, especially if stored in a damp place or exposed to humid air.

A mixture of eight measures of bran with one of powdered quicklime makes an excellent packing for eggs in transportation.

Water glass—silicate of soda—has recently been used in Germany for rendering the shells of eggs non-porous. A small quantity of the clear sirupy solution is smeared over the entire surface of the shell. On drying a thin, hard, glassy film remains, which serves as an admirable protection and substitute for wax, oil, gums, etc. Eggs thus coated and stored in charcoal powder or a mixture of charcoal and bran would keep a very long time.

In storing eggs in charcoal the latter should be fresh and perfectly dry. If the eggs are not stored when perfectly fresh they will not keep under any circumstances. A broken egg stored with sound ones will sometimes endanger the whole lot. In packing, the small end of the egg should be placed downward; if in charcoal or other powder they must be packed so that the shell of one egg does not touch that of another, the interspaces being filled with the powder.

Under all circumstances stored eggs should be kept in as cool a place as possible. Frequent change of temperature must also be avoided.

The Strength of Small Spruce Beams.

Mr. F. E. Kidder has recently performed a series of experiments at the Massachusetts Institute of Technology, having for their object the determination of the moduli of elasticity and of rupture in small beams of white spruce (*Abies alba*), and such other information as might be derived from the data obtained. The results of these researches are embodied in a paper read before the American Academy of Arts and Sciences and printed in the current number of the *Journal of the Franklin Institute*. The conclusions drawn from the results of the experiments are as follows: The modulus of elasticity depends not only upon the elasticity of the material, but also upon the length of time that the load is applied. When subjected to loads not exceeding one-sixth of the breaking weight, spruce beams do not take a permanent set; but even under very small loads, if applied for any length of time, there will be a temporary set. Knots and gnarls in beams loaded at the center, when not within one-eighth of the span of the center of the beam, do not materially affect the elasticity under small loads. Deflection is very nearly proportional to the load, far beyond the customary limits of the strain, and the modulus is consequently very nearly constant for all moderate deflections. A high modulus of elasticity does not always accompany high transverse strength. In spruce beams the upper fibers begin to rupture by compression under about four-fifths of the breaking weight, and the neutral axis, at the time of rupture, is very near the center of the beam, as shown by the fracture. Beams which are subjected to severe strains for a long time, bend more before breaking than those which are broken in a comparatively short time. The modulus of elasticity of small spruce beams, of a quality such as is used in the best buildings, may be taken at from 1,600,000 to 1,700,00 pounds, and the modulus of ru pture at 11,000 pounds.

LOAN EXHIBITION OF THE OHIO MECHANICS' INSTITUTE.

In view of the large assemblage of scientific men to be expected in Cincinnati during the convention of the American Association, beginning August 17, the department of science and arts of the Ohio Mechanics' Institute are organizing a preliminary loan exhibition of scientific apparatus, chemicals, microscopes, minerals and materials illustrating natural history and archæology. This exhibition will be open during the week of the association, in the Exposition Building, and it is expected that the exhibits will remain to compete for premiums and awards in the regular Exposition in September.

We are informed that from the number of applications for space already received the loan exhibition promises to be the largest of its kind ever held in this country. The display cannot fail to be interesting and instructive to the members of the association and the large number of students, teachers, engineers, and others likely to attend the meetings; and the opportunity for manufacturers and dealers to place their goods before those most likely to buy seems to be exceptionally promising.

The committee in charge consists of Prof. F. W. Clarke, of the University of Cincinnati; Prof. Wm. L. Dudley, Miami Medical College; E. A. Kebler, Esq.; J. B. Stanwood, C.E.; and Prof. Ormond Stone, of the Cincinnati Observatary.

THE JEANNETTE RELIEF EXPEDITION.

The Jeannette Relief Expedition, in the Rodgers (late Mary and Helen), sailed from San Francisco, June 16.

The Jeannette (formerly the Pandora) left San Francisco for Arctic exploration, by way of Behring Straits, July 8, 1879, under the command of Lieut. Geo. W. De Long, U. S. N., with a crew of thirty-one men. The Jeannette was last seen on the morning of September 3, 1879, in the neighborhood of Herald Island, sailing north.

The relief steamer Rodgers is commanded by Lieut. Robert M. Berry, U. S. N., and the other officers are Master H. S. Waring, Executive Officer and Navigator; Master Charles F. Putnam; Ensigns H. J. Hunt and G. M. Storey; Assistant Engineer A. V. Zane; Pay Clerk W. H. Gilder (late with the Schwatka Expedition); Passed Assistant Surgeon M. D. Jones, and Assistant Surgeon J. D. Costillo. The crew consists of a carpenter, a steward, two cooks, a blacksmith, three firemen, three machinists, and fifteen seamen.

The Rodgers is 155 feet in length and 30 feet beam, with a depth of 16½ feet, and registers 420½ tons. She is bark-rigged, with double topsails and auxiliary steam power, the engine developing about 156 horse power. She carries three years' full navy rations for her crew, besides a large quantity of pemmican and other stores, so as to be able, if necessary, to supply the Jeannette, or the missing whalers Mount Wollaston and Vigilant, which, with their crews of some sixty men in all, have not been heard of since, on the 10th of October, 1879, they were caught in the ice about eighty miles N. E. by E. of the spot where the Jeannette was last seen.

Chemical Examination of Drinking Water.

Dr. J. W. Mallet, University of Virginia, has undertaken for the National Board of Health a special study of the methods of examining drinking water for organic impurities; and the board urgently request that physicians and sanitarians shall promptly report to Dr. Mallet any well marked cases of disease which may seem on medical grounds to be fairly attributable to organic impurities in the drinking water used by the patient. It is further desired that samples of each such water shall be forwarded to Dr. Mallet for examination, but not until after the reasons for suspecting the water have been submitted to Dr. Mallet, and notice has been received from him that the analysts are ready to proceed with its examination. Such notice of readiness will be accompanied by clear instructions as to the quantity of water required, and the mode of collecting, packing, and shipping it. The cost of packages and transportation will be borne by the Board of Health. Dr. Mallet's post office is University of Virginia P. O., Albemarle County, Va.

It is to be hoped that physicians will not neglect to aid this important inquiry, especially as it furnishes so favorable an opportunity to have tested *gratis* any water the wholesomeness of which they may have cause to doubt.

Water in an Amethyst.

An Atlanta paper reports the recent finding, in Rabun County, Ga., of an amethyst bearing a drop of water or similar liquid in a cavity near the center of the stone. It is not an uncommon occurrence to find such water-filled cavities in crystals of quartz and other minerals, but this cavity in amethyst is said to be unique.

Exhibition of Milling Machinery.

The British *Mercantile Gazette* has the following respecting the threatened invasion of the domain of the English miller by their enterprising cousins of the far West:

It has been stated that there are 10,000 millers in the United Kingdom, and that a very large proportion of that number had not, previous to the late exhibition, even so much as seen the devices by the aid of which our American cousins have asserted they will, before long, secure for themselves the exclusive manufacture of the enormously increasing growth of American wheat that now flows into this country. To enable the British and Irish millers to take stock of their position, and decide whether they will give up the fight, as many of our British farmers are doing, or embark more capital, energy, and skill in their business, the Council of the National Association of British and Irish Millers resolved to hold an international exhibition of milling apparatus, and although only a comparatively short time elapsed between the mooting of the suggestion and the actual accomplishment of the intention, the display of milling machinery was emphatically the largest and finest ever made.

It is the surprising growth of the milling industry in the United States which fills our home trade with the most serious misgivings; for, whereas the quantity of flour coming from the States was only 1,772,000 cwt. in 1877, it was 3,635,000 cwt. in 1878, rose to 6,863,000 cwt. in 1879, and nearly reached 7,000,000 cwt. last year.

There is also every apparent indication of the permanency of the rapid increase. One authority has it that in the State of Minnesota alone the mills turned out 6,000,000 barrels of flour in the year 1879, and that the mills in Illinois, Wisconsin, Iowa, and other States produced no less than 15,000,000 barrels in the same year. The city of Minneapolis has twenty-two mills with a capacity of 15,000 barrels daily. At St. Louis nearly 2,000,000 barrels of flour were manufactured last year; and in both of these two great centers of milling industry a number of new mills are in course of erection. The substitution of flour for whole grain in exporting lessens the weight for land transport and shipment by about 30 per cent, as the proportion of fine baking flour yielded by the wheat is some 70 per cent; the remaining portion of inferior flour, offal, and bran being used as a valuable interchange with maize for fattening American cattle. Even the packing in bags in place of barrels has had its effect. It has contributed toward the economizing of room in the holds of vessels, and the matter of cost reduced to a minimum by the smaller outlay necessary for the bags, and the realizing of their values when discharged in this country. Indubitably, therefore, the situation is, "not to put too fine a point upon it," serious, and millers are apprehensive that their anticipations—that at a not very remote period the vast imports from the other side of the Atlantic may, for the greater part, if not indeed wholly, take the form of flour instead of grain—may assume an unpleasantly material aspect. Without wishing to be "alarmist"-like, or to prognosticate that our national milling industry will become obsolete, it serves no good purpose to mince matters, and the British miller had better look to his guns if he wishes to hold his own in the whirlwind of competition. If anything is calculated to stimulate the energies of English millers and millwrights, certainly the great exhibition at Agricultural Hall ought to have done much to obtain the desired effect.

Comparative Value of Steam Engines.

Hallauer's recent experiments have led him to the conclusion that the difference between engines of one and two cylinders, in point of economy, is very slight. In ranging from 80 to 8,000 horse power, with revolutions varying from 25 to 90 per minute, the expenditure of steam for a given amount of work remains the same for the same type of motor; the consumptions for two cylinder motors are identical for Woolf and compound, whatever may be the volumes of the cylinders, provided the motors are regulated so as to give the maximum efficiency; the expenditures of steam in motors of one, two, and three cylinders, suitably regulated and constructed, are so nearly alike that the choice may be governed in each instance merely by the fitness of the type of the engine for the particular purpose desired.—*Bull. de la Soc. Ind. de Mulhouse.*

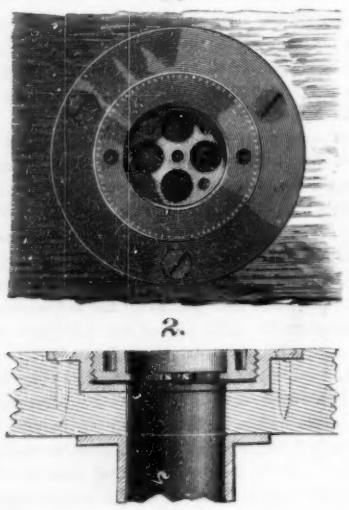
A NEW ballot box has just been submitted to the French government. It has two locks, each opening with a different key, and an apparatus which clips a stub or corner from the ticket deposited by the elector, and drops the stub into one part of the box, the ticket going into the other division. Simultaneously the machine registers on a tablet before the voter the number of tickets clipped. The ballots must agree in number with the stubs, and both with the "tell-tale," and the voter sees for himself that his ballot has been cast and taken account of.

THE *Archiv der Pharmacie* gives the following formula for making paper for wrapping up silver. Six parts of caustic soda are dissolved in water until the hydrometer marks 20° Baume. To the solution add four parts of oxide of zinc, and boil until it is dissolved. Add sufficient water to bring the solution down to 10° Baume. Paper or calico soaked in the solution and dried will effectually preserve the most highly polished silver articles from the tarnishing action of the sulphureted hydrogen which is contained in such notable quantities in the atmosphere of all large towns.

NEW STRAINER FOR THE OUTLET OF TUBS AND BASINS.

The engraving shows an improved strainer for the outlet of tubs and basins, recently patented by Mr. William Slow, 68 West Houston street, New York city. It can be readily removed from the washer of the outlet of a tank, tub, or basin, for the purpose of clearing it in case it becomes clogged.

The washer is recessed and internally threaded to receive the strainer, which is screwed in. A small wrench or key accompanies the strainer, and is used in removing it from the washer whenever it requires cleaning or when it becomes necessary to remove any obstruction from the pipe. The strainer may consist of an apertured plate, or it may be made of wire cloth secured to a suitable rim.



SLOW'S STRAINER FOR THE OUTLET OF TUBS AND BASINS.

Fig. 1 is a plan view of the strainer, and Fig. 2 is a vertical section showing the manner in which it is applied to the tub or basin.

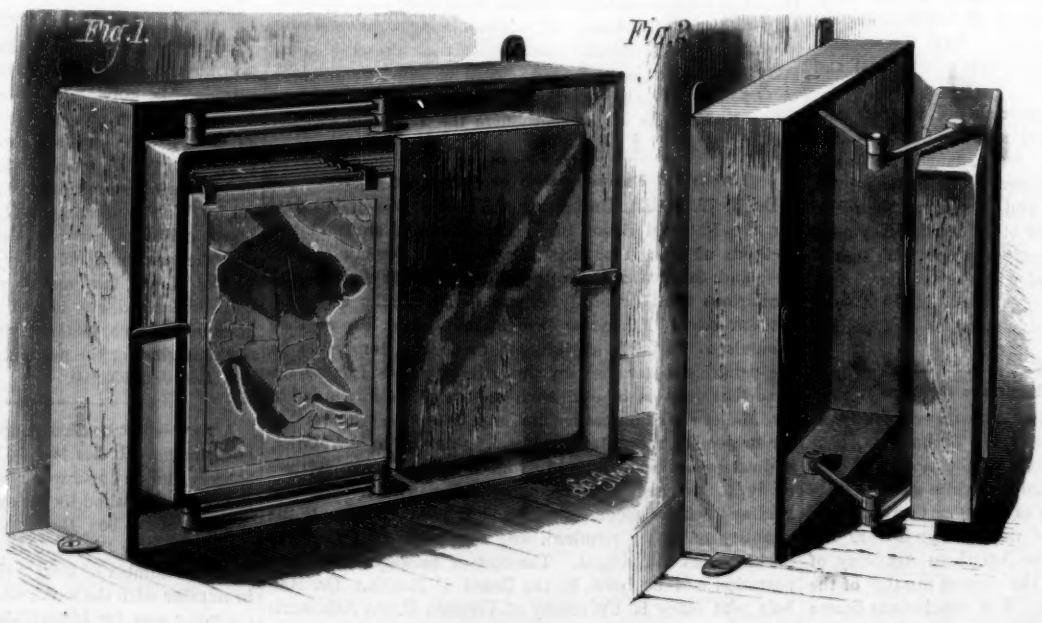
The World's Progress in Ten Years.

An English statistician, Mr. Michael G. Mulhall, gives the following figures as representing the world's increase in the elements of progress in the decade between 1870 and 1880: Percentage of increase in population, 9·76; in agriculture, 8·58; manufactures, 18·60; commerce, 38·20; mining, 47·06; carrying trade, 53·32; earnings of nations, 19·84; public wealth, 10·57; taxes, 22·34; public debt, 43·39. The tangible increase in public wealth since 1870 would suffice to pay off 88 per cent of all existing national debts.

NOVEL CHART RACK.

The engraving represents a novel chart rack for holding charts and maps, such as are used in school rooms for instruction, and for protecting the charts when not in use. It permits of showing either side of the chart or map. A reversible chart frame is supported by two jointed arms at the top and bottom in a fixed frame attached to the wall. One half of the reversible frame is covered to form a chamber into which the charts may be moved to shield them from dust and danger of mutilation when not in use. The charts slide upon rods, and may be viewed from either side by simply turning the reversible frame. The outer frame may be made portable and may be supported by an easel or movable frame. It is not limited as to size, and intended principally for use in schools, but it may be used to advantage in places of business for displaying samples, placards, etc.

This useful invention was lately patented by Mr. William C. Cadwell, of Logan, Iowa.



CADWELL'S CHART RACK.

Artificial Soil.

M. Dudouy, of Saint Ouen, has been very successful in chemical horticulture. In his garden he has cultivated legumes, flowers, and trees in parallel rows in three manners: 1, with ordinary manure; 2, with chemical manures in garden soil; 3, with a special compound, which he calls *floral*, in pure sand.

The results of the third experiments have been very striking, yielding the earliest, the largest, and the most delicate vegetables, as well as the most thrifty and brilliant flowers. The *floral* contains nitrogen, phosphoric acid, potash, magnesia, and sulphur, in a form so concentrated as to require dilution with twenty thousand times their volume of water. The experiments have been continued for five years with uniform success.—*Les Mondes.*

ENGINEERING INVENTIONS.

An improved railroad signaling apparatus, patented by Mr. Robert B. Sanderson, of Bridgewater, Pa., consists of a box having signal colors painted in sections upon its side, a pivoted skeleton plate, a pulley and cord, and a cord and weight, or equivalent spring, whereby the signals can be displayed by adjusting the skeleton plate.

Mr. George H. Knapp, of Brockton, Mass., has patented a novel arrangement of levers, in combination with the main and switch rail rods and movable rails of a railroad, whereby the switch is operated by the contact of strikers attached to the engine and controlled by the engineer.

With the ordinary bilge pumps it is impossible, when the vessel rolls heavily and quickly, to maintain a continuous discharge of the bilge water, for as the vessel rolls to starboard the suction pipe on the port side becomes bare and the water which is in it below the lower valve flows back into the bilge while only the pump on the starboard wing draws water until the vessel rolls back to port, when for some time neither pump works until the water can collect on the port side, when the port pump will operate. Considerable time thus elapses on each roll of the vessel before a pump has filled its suction pipe up to the lower valve, and by the time the pump begins to discharge the vessel will roll in the opposite direction. Thus the pumps work poorly and the water accumulates, and the result is that at every lurch the water rushes up in the wings of the vessel and injures the cargo; and on a steam vessel the water surges up on the stoke-hole plates and carries off ashes and coal into the bilge, causing the pumps to choke. Mr. Joseph J. De Kinder, of Philadelphia, Pa., has patented apparatus to overcome these difficulties; the invention consists in a device preventing the back flow of the bilge water from the suction pipes during the rolling of the vessel by alternately closing the valves of the suction pipes by means of a self-acting pendulous weight, the operation of the parts being such that as the vessel rolls, so as to leave the bottom of either of the bilge pump suction pipes dry or out of water, the valve of the pipe will be closed and the back flow of the bilge water in the pipe will be prevented.

An improved excavator has been patented by Mr. William H. Knight, of Quebec, Province of Quebec, Canada. The object of this invention is to furnish machines designed especially for excavating snow and earth upon lines of railway in course of construction or completed, but which may be used with advantage in excavating for other purposes.

Mr. W. Clay Lutz, of Bedford, Pa., has patented an improved hollow iron railroad tie, composed of an upper and lower section bolted together, the upper section being provided with a vertical web for receiving the rail.

Mr. John F. Anderson, of Jersey City, N. J., has patented an improvement in the construction of tunnels, the object of which is to facilitate the construction of tunnels where the earth is composed of soft materials such as sand and silt, and at the same time insuring greater safety for the men engaged in constructing such tunnels. The invention consists in constructing and carrying forward in the earth, in advance of the main tunnel, a central tube or small tunnel having a metallic shell, which the inventor terms a "pilot tunnel," by which the nature of the soil in advance of the main tunnel can be ascertained, and the earth at the heading may in part be supported during the excavation of the main tunnel. Another feature of the invention consists in extending the rear portion of the shell of the central or pilot tunnel back from the heading into the completed part of the main tunnel, and in using this shell as a temporary support for the walls and shell of the main tunnel during their erection.

AN IMPROVEMENT IN HORSE COLLARS.

We give an engraving of a useful improvement in horse collars, patented by Mr. Andrew D. Martin, of Abbeville, La. This collar is made by winding Spanish moss on a flexible base, such as a rope. It has the proportions and general form of a leather collar, but is superior in many respects. It is always soft and pliable, and will never injure or gall the flesh, while in many cases it has been known to heal a sore or gall produced by a bad collar. It admits air to the skin, and is in all respects comfortable and easy.

The inventor informs us that restive horses have been easily broken by the use of this collar, and that it is well and favorably known in all parts of Louisiana and in some of the other States.

MARTIN'S IMPROVED HORSE COLLAR.

The moss is wound upon the flexible base by means of machinery especially adapted to the purpose, which the inventor can supply to any one engaging in the manufacture of the collar.

Further information may be obtained from the inventor as above.

A Remarkable Drying Agent.

Anhydrous phosphoric acid is believed to be the most powerful desiccating agent known. When air from which moisture has been removed as far as possible by the ordinary means, and is then carefully dried by sulphuric acid at temperatures not exceeding 25° C., it is still found that the two-millionth part of the weight of the air in the form of moisture will be removed by the anhydrous phosphoric acid.

Central Sugar Mills in Louisiana.

An important innovation has been made in the working of sugar plantations in Louisiana by the success of an independent sugar mill in St. Mary's Parish. Hitherto the custom has been to work up the cane of each plantation in a plantation mill; and as the small farmer could not own or operate a mill the cultivation of sugar cane has of necessity been monopolized by wealthy planters. The effect of the independent sugar mills in providing a general market for cane cannot but be much the same as that produced in dairy regions by the establishment of central cheese and butter factories, or that in wheat-growing regions in separating the work of the farmer from that of the miller. The superior economy of grinding the cane and converting the juice into sugar in a few large and well appointed factories, instead of a multitude of small and rude establishments, is obvious. But a still greater advantage is promised from the circumstance that the new plan enables small farmers to engage in cane growing, thus removing the necessity for large plantations and making possible a vast extension of the area devoted to sugar. At the mill referred to the cane is purchased by the ton, in any quantity offered; and similar factories are being projected in other parts of the State.

ALUM water is recommended for preventing bugs and worms from infesting flouring mills. Take two pounds of alum and place it in three quarts of warm water (or in that proportion), and let it stand on the stove until the alum disappears. Apply while hot with a brush to the crevices of the bolting machine and other places that conceal the insects.

IMPROVEMENT IN STEAM BOILER FURNACES.

The engravings show what the inventor calls a rational construction for generating steam. And the reason why it is called a rational construction is because it utilizes heat that is wasted and lost in all other forms of steam boilers set in brick.

On the side walls of an ordinary boiler set in brick, and on the side of the grate bars, there are some sixty square feet of surface, that absorb fifty per cent of the heat of the fuel.

If the users of steam boilers, as usually set, realized the full value of their fuel, they would, in most cases, be able to evaporate at least fourteen pounds of water to each pound of coal consumed; whereas, with imperfect construction and setting, it is a rare thing to find them that evaporate (allowing for dry steam) over seven pounds of water for each pound of fuel. To overcome this deficiency in the imperfect setting of steam boilers, Mr. Charles D. Smith—who is connected with the house of Edward Barr, 78 John street, New York city—has invented and constructed a furnace that has been applied to a large number of boilers, both new and old, and, as we have been informed by parties using it, with great success. At the brewery of Anton Hupfels, 38th street and Third avenue, they formerly used two horizontal tubular boilers, 54 inches diameter by 16 feet long. To one of these boilers, one of these furnaces was attached three and a half years ago, since which time this boiler and furnace have done the work that formerly required both boilers, notwithstanding an increase of business. This increase in efficiency was secured without expense to boiler or furnace, and effected a saving of fuel.

We are informed that three years ago two boilers, with furnaces attached, were placed at Lord & Taylor's, corner of 20th street and Broadway. The chief engineer, Mr. Scott, who has been in charge there for eleven years, tells all who inquire that he effects a saving of 28 per cent in fuel alone.

The improvement has also been applied in the brewery of Donald Smith, on 18th street and Eighth avenue, with the same results.

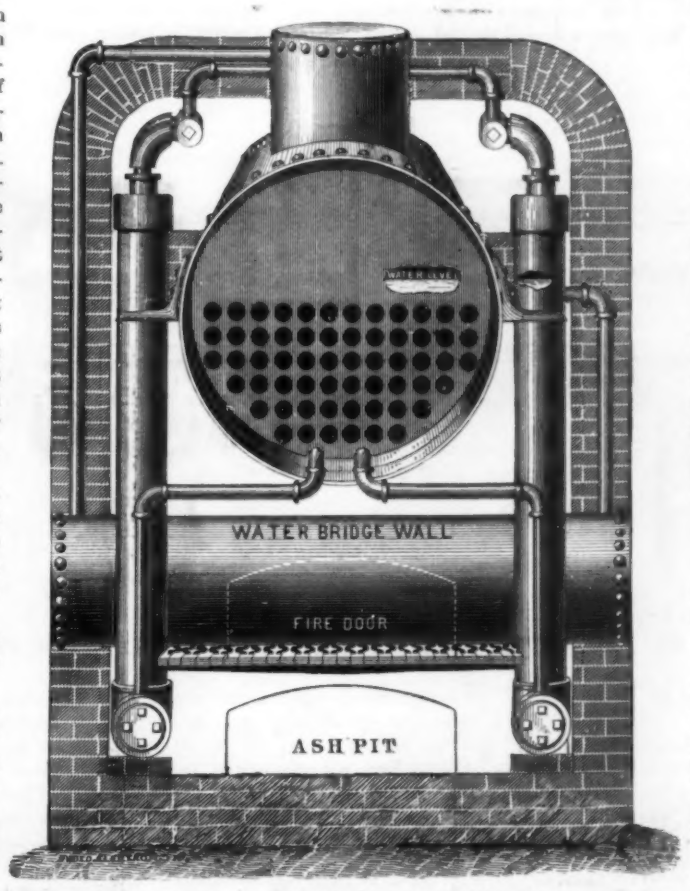
We are informed that the improvement has been adopted by the following large corporations: Cambria Iron and Steel Works, Johnstown, Pa.; Merchant's Mills, of Fall River, Mass.; Manhattan Silver Mining Company, of Austin, Nev.; George Ehret, brewer, New York, who, after using it for three years, applied it to all his boilers. Many others have adopted it.

The columns on the sides take the place of the wall of fire brick each side of the grate bars. They are made of five-inch pipe, and will stand a cold water pressure of 2,000 pounds to the square inch. The round bridge wall is made of steel plate. It is 14 inches in diameter, and takes the place of the brick bridge wall. The pipes from the bridge back are 2½ inches in diameter, and in an ordinary boiler add about 200 feet to the fire surface. The fire surface required is but 4 square feet to a horse-power; in heating surface, as generally estimated, 12 to 15 square feet are required.

The larger engraving is a side elevation of the boiler with parts of the arch, boiler, and tubes broken away to show interior construction. The smaller engraving shows the boiler and arch with the front removed.

The judges' report of the test of steam boilers at the Centennial Exhibition, in Philadelphia 1876, shows that the application of these water walls to a horizontal tubular boiler gave a higher evaporation by over 12 per cent, with an increased capacity of 74 per cent over any other boiler competing in the test, showing that the fuel generally wasted amounts to 65 per cent of the amount used.

Further information as to construction, operation, etc., may be obtained by addressing Mr. Edward Barr, dealer in iron pipe and steam supplies, and sole manufacturer of Smith's furnace, 78 John street, New York city.



END VIEW OF BOILER WITH SMITH'S IMPROVED FURNACE.

The Electric Light for Deep Water Investigations.

Some interesting experiments have been made at Baltimore to test the applicability of the electric light for deep water investigations, the aim being to illuminate brilliantly the water and the bottom to depths of two hundred feet or more. The tests were made with a Brush apparatus operated by an eight horse power engine, mounted upon a scow and towed about the harbor by a tug boat. The results obtained were not fully satisfactory, owing principally to the roughness of the water, but the trial was a most interesting one, and the power of the electric light was strikingly manifested.

A movable parabolical reflector was used back of the light, which was again and again thrown against vessels from two to two and a half miles distant, bringing them out in clear, full view, and enabling their names to be read with the aid of a glass. When the light was thrown upon the dome of the City Hall, it leaped out of the darkness and stood up against the dark sky as if suspended in mid-air. One of the curious features of this part of the display was that to persons in the city the shadows of steamers and other vessels, passing between the light and the City Hall dome, were distinctly portrayed against the white background.

The Telephone in Hungary.

Mr. D. H. Washburn, who has been engaged for some months introducing the telephone into Buda-Pesth, Hungary, reports very encouraging success. He writes that the director of the company, Mr. Francis Puskäs, had obtained the exclusive right to use the telephone in Hungary, and that connections were being made between Buda-Pesth and the adjacent towns. The charge for the service is 15 guilders—about $6—a month. The Edison transmitter is used with magnetic call. Supplies are got mainly from New York.

Mr. Washburn finds the Hungarians very backward in the adoption of modern improvements. A good mechanic in Buda-Pest gets from $6 to $10 a week, and does as much work as an American, with improved tools, could do in an afternoon. The cost of living is reasonable, a good dinner with wine costing about 75 cents. The beef is poor, and the pork dear, a guilder (41 cents) a pound. Vegetables are good and cheap. Rents are not high.

As an indication of the inconveniences of a paternal government Mr. Washburn mentions the fact that before a man can subscribe to the telephone exchange his name and business have to be sent to four different government offices for permission. The telephone company has to report to the authorities what everything costs and what every employe receives. "In fact," adds Mr. Washburn, "every one that lives here is but a slave of the government."

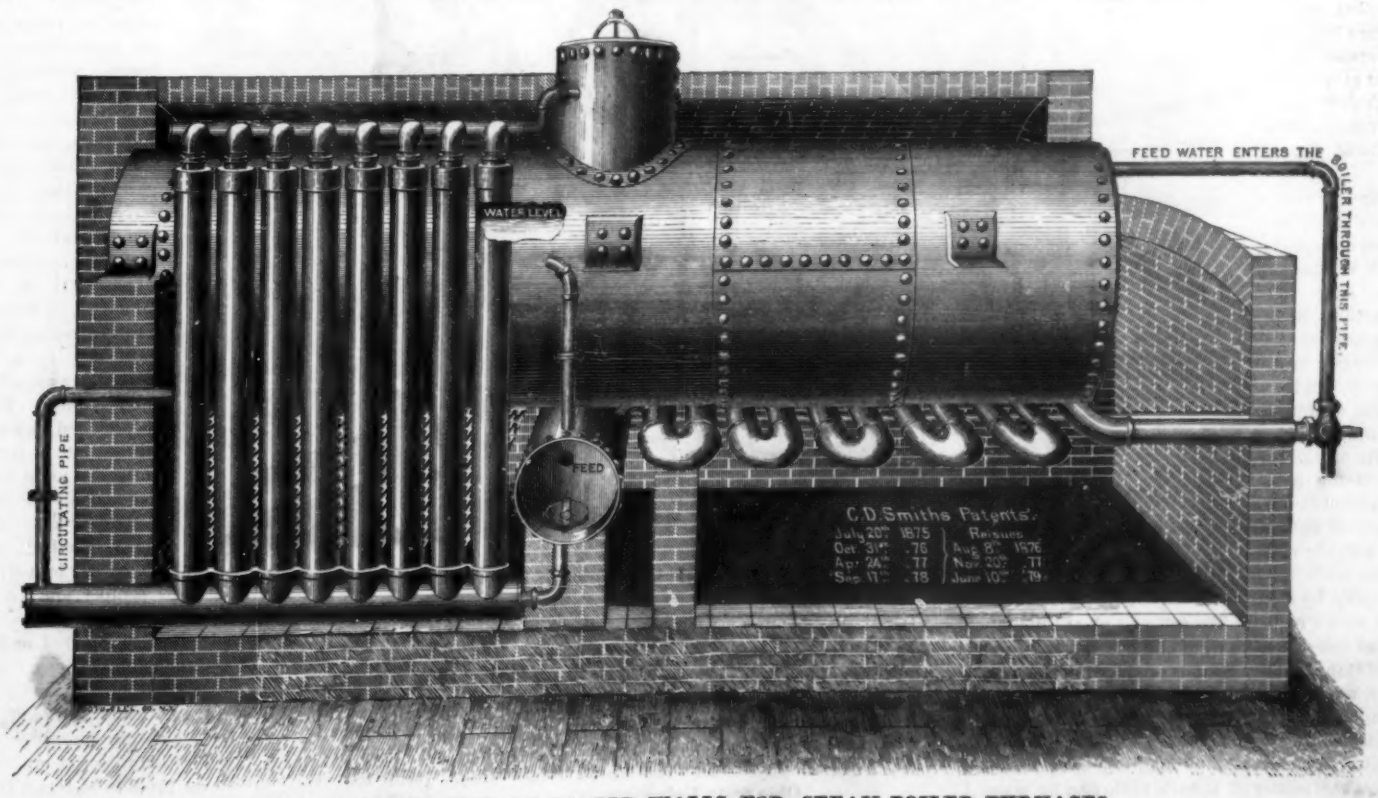
NEW INVENTIONS.

An improved adjustable rack, to be attached to brass band instruments, for holding books or leaves of music, has been patented by Mr. Charles Parent, of Biddeford, Me.

A telegraph operator at a railroad station is responsible for the switches, and is required to telegraph the approach of trains. Besides this he has frequently to answer inquiries from other stations as to whether certain trains are approaching, and usually attends to the ordinary telegraph business. To watch the track he must frequently leave his table, especially if the track is curved, so that his work is not only interrupted, but there is more or less risk of its being improperly done. Mr. Sidney L. Palmer, of Serena, Ill., has patented an arrangement of reflecting mirrors, which convey to the operator's table a picture of the track extending in both directions from the station.

In training horses for trotting, toe weights are attached to their shoes to cause the horses to throw out the fore feet and make longer strides, but after a little service the weights in common use become loose and are with difficulty tightened on the shoe spur or clip. To avoid this difficulty, Mr. Peter Broadbooks, of Batavia, N. Y., has patented an adjustable toe weight that can be securely held in place.

An improved earring fastener, patented by Mr. Geo. Krementz, of Newark, N. J., consists in a forked spring sliding in a circularly-bent tube, and having an ear wire projecting from one end of the bent tube attached to one shank, the other shank being provided with a catch for locking the spring and the ear wire.



SMITH'S WROUGHT IRON WATER WALLS FOR STEAM BOILER FURNACES.

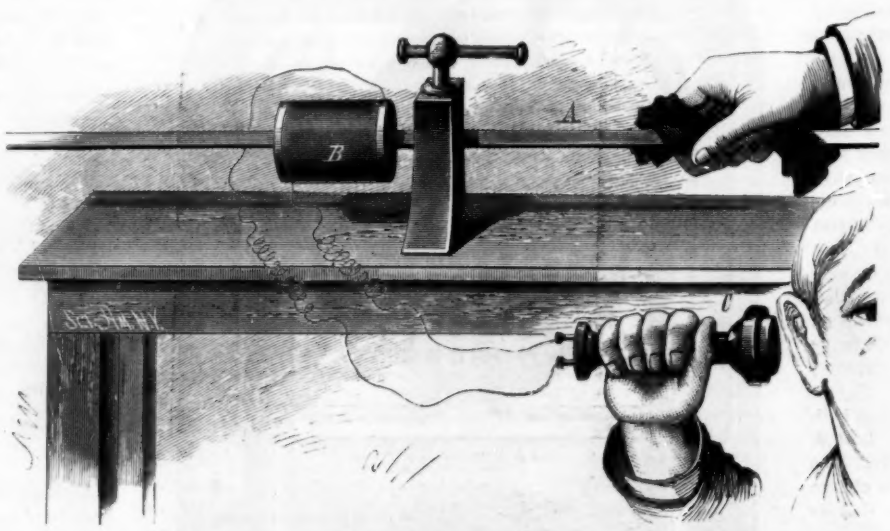
ELECTRIC INDUCTION BY STRESS.

Joule has shown that when a bar of iron is magnetized by means of a helix and electric current the bar is elongated appreciably. These elongations have been measured by Prof. E. A. Dolbear.

While undertaking some experiments in December, 1878, it occurred to me that the inverse of this ought to be true, namely, the forced elongation of a bar of iron, surrounded by a helix, would give cause for an electric current through the helix and connections. A series of experiments followed which completely verified the supposition, a recital of which may be of interest. The publication of them was deferred from time to time in the hope of more varied experiments, and in the possible discovery of like experiments by others.

By placing one branch of a sounding tuning fork near the pole of an electro-magnet, the coil of the latter having a Bell telephone in circuit, the tone of the fork is found to be reproduced in the telephone. But this is like using a Bell telephone for a transmitter, the branch of the fork in the present case serving for an armature, as does the diaphragm in that instrument. Again, when an iron bar is fastened at its center and made to vibrate longitudinally near an electro-magnet, a telephone in circuit will speak, and for the same reasons as before. Remove the core of the magnet and the sound is still heard at the telephone, and it is not necessary that the bar be a magnet. Bars of iron were selected that possessed a minimum amount of magnetism, in fact an almost inappreciable magnetism, and still a loud sound was emitted by the telephone.

The helix used had no iron about it when the core was removed, and the opening for the core was large enough to encompass the bar without touching it. The bars used were several times the length of the helix.



MANNER OF PRODUCING ELECTRIC INDUCTION BY VARYING STRESS.

At first it was supposed that the *motion of* the iron longitudinally was chiefly concerned in the production of sound. On this supposition the sound would diminish as the helix was moved toward the middle of the bar where it was firmly secured in a clamp for longitudinal vibration. But instead of this, the intensity was increased; and to such an extent that the auditor at the telephone in a distant room could positively say whether the coil was at the end or at the middle of the longitudinally vibrating bar. This made it clear that the sounds observed were not to be explained altogether on the ground of vibratory motion of the particles of the bar, because the motion of the bar at its middle is *nil* when clamped at this point and vibrating longitudinally at its fundamental; while at the ends we have a maximum degree of vibratory motion. But at the middle of a bar thus conditioned we have a node, and the strains are here known to be those of extension and compression and at a maximum for the bar, while at the ends the alternating strains are *nil;* that is, where the motion is greatest the strains are least, and *vice versa*. It seems, therefore, certain that at the middle the sound is chiefly due to the vibratory stresses, while at the ends it is almost entirely due to motion.

The engraving shows the apparatus. Rods were used which were from one-quarter to one-half inch in diameter and three feet long The coil was about three inches long, and so connected with the free circuit wires that it could readily be moved along the rod. As the clamp prevented placing the coil exactly at the middle of the bar, the latter, to test this point, was taken out and suspended by two filaments so light as not to interfere with the vibration, and the bar made to vibrate longitudinally by striking on the end with a mallet. The coil was placed directly at the middle and also shifted to right and left, but the sound was still loudest at the middle. Sounds produced by the transverse vibrations, now accidentally occurring and mixing with those due to the longitudinal vibrations, were heard, but were readily distinguished by the pitch of tone. These were separated from the above consideration of longitudinal vibrations.

To further test the matter of electric induction by stress, a rod was passed through the coil, and the rod put under tension in a testing machine. A galvanometer now placed in the circuit became very active as the strain was put on. The bar was an ordinary three-eighths rod of commercial bar iron. It was at once found to be permanently stretching, and the galvanometer needle was all the while flying about as the extension continued. When the bar was removed it was found to be strongly magnetic, much more so than it could have been when put in. It was also heated. It therefore seemed difficult to determine whether the observed currents of electric induction were due to strain, stretch, magnetism, motion, or heat, in part or together.

A piece of white chilled cast iron was then tested to 42,000 lb. compression, and found to resist the full power of the machine without crushing or set. The coil was then placed around the rod, and the test for stress electric induction applied. Under compressive strains the needle gave unmistakable evidence of electric currents, though they were much feebler than in the previous case of soft iron.

Experiments on steel bars, not magnetized, gave appreciably the same effects as iron bars. Magnetized steel was not tried, but it is presumed that at the end of the bar magnet vibrating longitudinally the sounds would be intensified, while at the middle of the bar, normally magnetized, the sounds probably would not materially differ from those obtained from non-magnetic bars.

A few other metals were tried, copper and brass particularly, but no sounds were heard from them. These experiments, though far from being complete and exhaustive of the subject, warrant us in the following conclusions, namely:

1st. That the fact of Joule, of the distortion of bars of iron by magnetization with electric currents, is operative in the inverse order, namely, distortion of bars by mechanical force induces electric currents in surrounding coils.

2d. Most other metals than iron or steel give but feeble if any observable results of stress-electric induction.

S. W. ROBINSON,
Professor of Physics and Mechanical Engineering,
Ohio State University

RECENT INVENTIONS.

An improved tip for lamp-wick tubes has been patented by Mr. Hamilton B. Follett, of Brooklyn, N. Y. The object of this invention is to produce a very brilliant and regular flame in a kerosene lamp or stove, and to prevent any irregular or undue carbonizing of the wick. It consists in a small plate of metal, which passes edgewise and longitudinally over the middle of the upper edge of the wick tube, a short distance above.

Mr. Alfred I. E. Knight, of New York city, has patented a convenient inkstand or cabinet constructed with means for holding pen holders, sponges, rules, etc., and also a central removable panel, ornamentation, or calendar, and formed with surfaces adapted for emblematical or lettered advertising.

An improved apparatus for stowing cotton bales in vessels has been patented by Mr. John F. Taylor, of Sharon Springs, N. Y. The object of this invention is to facilitate the stowing of cotton bales in vessels, and enable the stevedores to stow a much greater quantity in a vessel than is possible when the stowing is done in the ordinary manner.

Mr. George Hill, of White Hall, Ill., has patented an improved stew pan which can stand very intense heat without breaking, has a support that admits of a circulation of air under the vessel, and has ears for fastening the bail, which are so protected that they cannot be broken off by slight jars or shocks, as is the case with the ears of the ordinary earthenware pan.

Pocket scales designed especially for physicians practicing in the country and in small towns, where it is necessary for them to carry and weigh out their medicines, for family use in weighing medicine, and for prescriptions and other delicate weighing, have been patented by Mr. Isaac S. Hopkins, of Oxford, Ga.

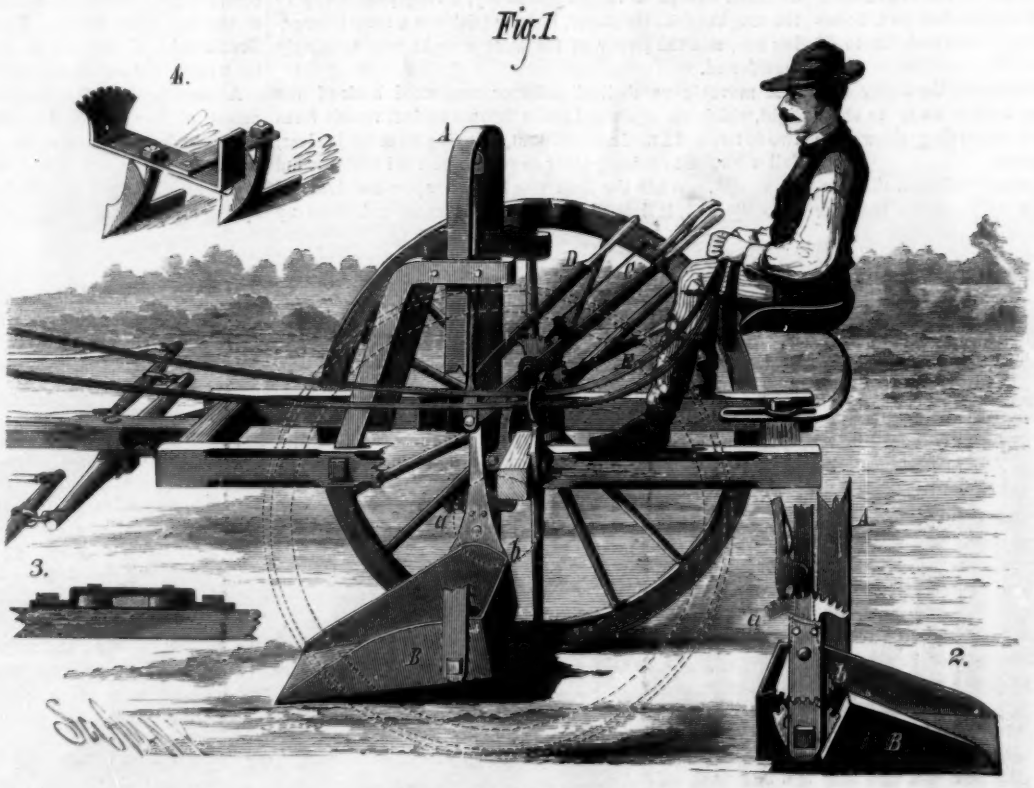
An improved device for testing milk by comparing its color with a scale of shades of colors, has been patented by Mr. Friedrich Heeren, of Hanover, Germany.

An improved last, for the manufacture of boots and shoes, has been patented by Messrs. John Martin and Josiah Merrill, of Great Falls, N. H. It can be changed to suit the style at a small cost.

NEW ROAD SCRAPER.

We give herewith an engraving of an improved road scraper for moving dirt from one locality to another and for leveling and grading. It is mounted on wheels and is provided with levers, by means of which every movement of the machine may be readily controlled by the driver, who sits on the seat at the rear of the main frame.

Fig. 1.



AGEE'S ROAD SCRAPER.

For the sake of showing the working parts of the machine one of the supporting wheels is removed, and parts of the framing are broken away.

A forked frame, A, is guided in roller bearings in the main frame and in the braces extending upward from the frame, and has pivoted between its lower ends the scraper, B, which is made either wholly or in part of iron or steel. A lever, C, is fulcrumed on a standard attached to the axle, and is connected with the upper part of the forked frame, A, by means of a connecting rod, so that the support may be moved up or forced downward as occasion may require. The lever, C, is provided with a pawl which drops into a toothed sector attached to the lever support, and holds the frame, A, at any desired height.

A toothed sector, *e*, is secured to the side of the scraper, and is engaged by another toothed sector, *b*, pivoted to the frame, A, and extended upward and backward, forming the lever, D, and the latter carries a toothed sector, *a*, which is engaged by a pawl pivoted to the side of the frame, A, and extended upward and rearward, terminating in the handle. This pawl locks the scraper securely at any desired angle that is in position to scrape up the earth, or with the edge elevated in position to retain the earth. It will be seen that with mechanism thus arranged the driver

can, without difficulty, depress the scraper and hold it, or he can raise it and hold it, or manipulate it in any desired way without a great deal of exertion.

Fig. 2 shows the details of the mechanism for operating the scraper. Fig. 3 shows the roller guide for the frame, A, and Fig. 4 shows a plow attachment that may be used in place of the scraper for loosening the soil preparatory to removal by the scraper. One of the plows is secured directly to the pivoted bar, and the other is secured to a short beam extending backward. These plows are raised, lowered, and tipped in one direction or the other by the levers used to operate the scraper. If desired, a single plow may be attached to the center of the pivoted bar.

The merits of this device will be appreciated by any one having had much experience with ordinary scrapers.

Further information may be obtained by addressing the inventor, Mr. G. S. Agee, Mint Hill, Osage county, Mo.

Elasticity Viewed as Possibly a Mode of Motion.

At a recent meeting of the Royal Institution, Sir Willim Thomson, LL.D., F.R.S., etc., said, with reference to the title of his discourse: "The mere title of Dr. Tyndall's beautiful book, 'Heat a Mode of Motion,' is a lesson of truth which has manifested far and wide through the world one of the greatest discoveries of modern philosophy. I have always admired it; I have long coveted it for elasticity; and now, by kind permission of its inventor, I have borrowed it for this evening's discourse.

"A century and a half ago, Daniel Bernouilli shadowed forth the kinetic theory of the elasticity of gases, which has been accepted as truth by Joule, splendidly developed by Clausius and Maxwell, raised from statistics of the swayings of a crowd to observation and measurement of the free path of an individual atom in Tait and Dewar's explanation of Crookes' grand discovery of the radiometer, and in the vivid realization of the old Lucretian torrents with which Crookes himself has followed up their explanation of his own earlier experiments; by which, less than two hundred years after its first discovery by Robert Boyle, 'the Spring of Air' is ascertained to be a mere statistical resultant of myriads of molecular collisions.

"But the molecules or atoms must have elasticity, and *this* elasticity must be explained by motion before the uncertain sound given forth in the title of the discourse, 'Elasticity Viewed as Possibly a Mode of Motion,' can be raised to the glorious certainty of 'Heat a Mode of Motion.'"

The speaker referred to spinning tops, the child's rolling hoop, and the bicycle in rapid motion as cases of stiff, elastic-like firmness produced by motion, and showed experiments with gyrostats in which upright positions, utterly unstable without rotation, were maintained with a firmness, strength, and elasticity as might be produced by bands of steel. A flexible endless chain seemed rigid when caused to run rapidly round a pulley, and when caused to jump off the pulley, and let fall to the floor, stood stiffly upright for a time till its motion was lost by impact and friction of its links on the floor. A limp disk of India-rubber caused to rotate rapidly, seemed to acquire the stiffness of a gigantic Rubens' hat brim. A little wooden ball, which, when thrust down under still water, jumped up again in a moment, remained down as if embedded in jelly when the water was caused to rotate rapidly, and sprang back as if the water had elasticity like that of jelly when it was struck by a stiff wire pushed down through the center of the cork by which the glass vessel containing the water was filled. Lastly, large smoke rings, discharged from a circular or elliptic aperture in a box, were shown, by aid of the electric light, in their progress through the air of the theater when undisturbed. Each ring was circular, and its motion was steady when the aperture from which it proceeded was circular, and when it was not disturbed by another ring. When one ring was sent obliquely after another, the collision or approach to collision sent the two away in greatly changed directions, and each vibrating seemingly like an India-rubber band. When the aperture was elliptic, each undisturbed ring was seen to be in a state of regular vibration from the beginning, and to continue so throughout its course across the lecture room. Here, then, in water and air was elasticity as of an elastic solid, developed by mere motion. May not the elasticity of every ultimate atom of matter be thus explained? But this kinetic theory of matter is a dream, and can be nothing else, until it can explain chemical affinity, electricity, magnetism, gravitation, and the inertia of masses (that is, crowds of vortices).

Le Sage's theory might easily give an explanation of gravity and of its relation *to inertia of masses*, on the vortex theory, were it not for the essential allotropy of crystals, and the seemingly perfect isotropy of gravity. No finger post pointing toward a way that can possibly lead to a surmounting of this difficulty, or a turning of its flank, has been discovered, or imagined as discoverable. Belief that no other theory of matter is possible is the only ground for anticipating that there is in store for the world another beautiful book to be called "Elasticity a Mode of Motion."

Drawings of Washington Monument Memorials.

A series of drawings of the various memorial stones contributed to the Washington Monument at Washington, was made thirty-one years ago, during leisure intervals, by Roger Williams Wilcox, then a young patent-model draughtsman. He died the following year; but his sketches were carefully treasured by his mother; and now in her old age they have been purchased by the Monument Association.

The stones form the inner walls of the memorial chamber in the base of the great monument. Many of the stones are of costly character, with highly wrought emblems and inscriptions upon them. The drawings are of especial value, because they represent the individual stones as they appeared soon after arrival in Washington, and before they were set up within the monument.

PORCELAIN URN.

Nothing is more beautiful than some of the richly ornamented pieces of pottery turned out of the factory at Sevres. The engraving shows a fine specimen of Sevres porcelain

PORCELAIN URN FROM KENSINGTON MUSEUM.

preserved at the Kensington Museum. It is remarkable for the elaborateness of its design and the delicacy with which it is treated in every part.

Stress and Strain.

At a recent meeting of the Royal Society, a paper on "The Influence of Stress and Strain on the Action of Physical Forces," was read by Prof. W. Grylls Adams, M.A., F.R.S. It was Part I., and related to elasticity: "Young's Modulus." A large number of experiments with different loads were made, and after many unsuccessful attempts to account for certain discrepancies which could not be explained away as errors of observation, the following facts were elicited:

1. After a wire has suffered permanent extension, the temporary elongation which can be produced by any load becomes less as the interval between the period of permanent extension and that of applying the load becomes greater.

2. This increase of elasticity is greater in proportion for large loads than for small ones.

3. The increase of elasticity takes place whether the wire be allowed to remain loaded or unloaded between the period of permanent extension and that of the testing for the elasticity.

4. The rate of increase of elasticity varies considerably with different metals; with some the maximum elasticity is apparently attained in a few minutes, and with others not till some days have elapsed, iron and steel being in this last respect very remarkable.

5. The elasticity can also be increased by heavily loading and unloading several times, the rate of increase diminishing with each loading and unloading.

6. A departure from "Hooke's law" more or less decided always attends recent permanent extension, even when the weights employed to test the elasticity do not exceed one-tenth of the breaking weight.

7. This departure is diminished very noticeably in the case of iron, and much less so in the case of other metals, by allowing the wire to rest for some time either loaded or unloaded; it is also diminished by repeated loading and unloading.

The effect of permanent extension on the value of "Young's modulus" was tried according to the direct method for iron and copper, and indirectly for most of the metals.

Steam Whistles in a Fog—Curious Phenomena.

Captain Shirley, of the steamer City of Lawrence, of the Norwich and New York Transportation Company's line, reports a strange phenomenon on the Sound during foggy nights, which is worthy the investigation of scientific men. He says that when the steamer City of Lawrence was three or four miles east of Stratford Shoals light, on the night of the 12th May, he heard a whistle which sounded off the starboard bow. He blew the whistle of his boat several times, giving two blasts each time, but could get no reply. He stopped his boat, blew three whistles, and was delayed some three minutes, when the steamer State of New York suddenly appeared, blew two whistles, and passed him on the left. On the same night, when near Faulkner's Island, the State of New York whistled to the north of the Lawrence. She blew two whistles, and the New York returned one blast, and she passed to the southward. Capt. Shirley did not hear her whistle from the time that he heard her first blast until she passed him. Whistles were heard to the eastward, but not to the westward that night.

Sunday night, when the Lawrence was two miles from Bartlett Reef lifeboat, the bell was heard plainly, but when the Lawrence had got within a mile of the lifeboat they lost the sound until within an eighth of a mile of it, when they saw the glimmer of the light. The same phenomenon occurred off the Cornfield light.

The water was calm, and a light northeasterly breeze was blowing. When off Huntington, on the same night, Captain Shirley heard a whistle blow four or five times. It then grew fainter and fainter, until it could be no longer heard. He thought that it was a steamer going away from him. After running for two or three minutes, he heard a whistle close ahead on the starboard bow. The Lawrence blew three whistles and backed, and had to hail a large tug with barges in tow to leave their helm to their starboard to prevent a collision. The tug passed the Lawrence with but ten feet of lee room. Capt. Mott, an old Sound navigator, remembers the occurrence of similar phenomena on the night of the collision between the steamers Stonington and Narragansett, in June, 1880.

Why the sound of whistles is not conveyed as well on a foggy night as on a clear one is a problem to be solved. It cannot be attributed to head winds or heavy seas for the sea was calm and the air almost motionless. The signals at Huntington and Execution lights have been heard over fifteen miles against a northeast gale. The navigators of the Sound are anxious to have the phenomena explained.—*Norwich (Conn.) Bulletin.*

Elevated Railroads.

Elevated railroads are now entitled to rank among American institutions, and in the future will call for a large consumption of iron. There are, according to the *Iron Age*, three schemes of this character under discussion in St. Louis, and the only question is which shall be adopted. Philadelphia is making good progress in following the example of New York. Brooklyn encounters an obstacle, partly arising from the configuration of the surface, which favors the construction of tunnels, but the city is in desperate need of some form of rapid transportation. Boston hesitates, apparently on account of objections to architectural disfigurement. But elevated railroads in all our large cities is only a question of time, for while individual pieces of property may be injured by their propinquity, millions are added to the aggregate assessable value, and their convenience is beyond calculation.

The latest phase in New York is the employment of elevated roads for the transportation of freight. By no other method yet contrived can the jam of vehicles on our water front be relieved.

Correspondence.

Gamgee's Zeromotor.

To the Editor of the Scientific American:

Having some few years ago, in conjunction with Mr. Maxwell Lyte, F.C.S., made some experiments with liquid anhydrous ammonia as a motive power, I ask leave to make some remarks on Professor Gamgee's proposed engine; for it seems to me that both he and his critics have failed so far to put the matter in its true light.

You correctly state in your article of the 14th ult., that his engine is analogous to a steam engine which should exhaust into its own boiler. But it would be incorrect to say that such an engine would not work. An engine with a surface condenser, from which it draws the feed water for its boiler, does in fact exhaust into its own boiler. In such an engine heat is first introduced into the water from the heated gases in the fire box and tubes; and after the steam has done its work in the cylinder, it is condensed through the abstraction of heat by a stream of cold water. But the heat introduced in the boiler is found to be in excess of that abstracted in the condenser by an amount directly proportional to the work done by the steam in the cylinder. Consequently a certain amount of condensation has taken place before the steam enters the condenser.

In Professor Gamgee's proposed engine, atmospheric air or water at the same temperature is to be used as the heating medium, as the liquid in the generator is boiling at a much lower temperature. There is no condenser, or, as Professor Newcomb puts it, "there is no external source of cold." There, is, however, an abstraction of heat due to the work done in the cylinder, and to this extent a partial condensation of the vapors, the volume of which, at the initial pressure, being thus reduced, a smaller mass of vapor at the initial pressure and temperature will suffice to force it back into the generator. The balance of a mass of vapor equal to the original mass is then available to do a certain amount of outside work. The heat lost in the cylinder is to be replaced in the generator, as above stated.

It is, then, still the old story of the "*conservation of energy;*" and, theoretically, such an engine, after making its first stroke, ought not, as said by Professor Newcomb, to stop; but, if its parts are all properly proportioned, the cylinder and pipes perfectly non-heat-conducting, and the temperature of the air remain constant, it ought to go on continuously, doing a given duty.

But when we consider it from a practical point of view, we find, first, that a colossal engine will be required to do a very small amount of work.

In a condensing steam engine there is a difference of about 1,000 degrees (Fahr.) of heat between the steam issuing from the boiler and the water returning to it. On the other hand, in Professor Gamgee's engine, this difference will not exceed 60 degrees. There is no advantage to be gained by working with high ratios of expansion in this engine, as the heat converted into energy during the expansion will be restored during recompression. Without going into the question of the relative specific heats of water and ammonia, we may say roughly that, for the two engines to indicate the same power when working at the same number of revolutions, they must have cylinder capacities in inverse proportion to the above differences of heat respectively. Again, in the steam engine the difference of temperature between the gases in the fire box and the water in the boiler is about 2,000 degrees (Fahr.). In Professor Gamgee's engine, if a pressure of 100 pounds per square inch is to be maintained, the difference of temperature between the heating medium and the contents of the generator cannot exceed 60 degrees. We shall not be far wrong in saying that the heating surfaces of the two engines must be in inverse proportion to these differences of temperature respectively. If Professor Gamgee employ a continuous stream of water as his heating medium instead of air, his heating surface may probably be reduced to one-quarter that required for air; but then he is dependent for his stream of water on some force external to his engine, and which might probably be more usefully employed.

It is scarcely worth while going into any more practical objections to his engine, such as the loss of power through priming, leakage, and heat conduction through the parts of the engine, and many other points. I will only point out that a considerable amount of some form of energy will have to be employed to produce the anhydrous liquid ammonia, a great deal of which energy will be lost for any useful purpose in the shape of heat dissipated in the air, or perhaps a stream of water produced for the purpose. His engine will have to do, in order to pay for this, a very much greater quantity of useful work than I believe will ever be got out of it; for I doubt very much myself if it will even overcome its own internal friction.

VALENTINE G. BELL, M.I.C.E.,
Chief Resident Engineer, Jamaica Government Railways.
Kingston, June 4, 1881.

Pin Worms, and How to Get Rid of Them.

To the Editor of the Scientific American:

It is exceedingly desirable that people should know more of the history of *Ascaris vermicularis* (pin worm). Encyclopedias give everything about them excepting what we ought to know, even the pictures. Please give us a paper on the subject, not for scientists, but for parents. I am a man 60 years old, and shall die of them. I know of no relief for their poison but cool injections. Every few weeks they produce diarrhea, and the visible surface of my outflow will give fifty to the square inch, to say nothing of the millions out of sight. After these liberal outflows there is a *short* relief, but only *short*. We wish to know:

1. Where is their original home?
2. How do they enter our body?
3. How many days' incubation?
4. How many days' life?
5. Are not the eggs laid inside as well as outside the bowels?
6. Is it certain that they occupy only about five inches of the rectum?
7. How to be rid of the few left for seed after every looseness?
8. If derived from food, why all persons are not infected?

Please let these eight questions be answered, and oblige, yours faithfully, AN OLD SUBSCRIBER.

Boston, June 6, 1881.

Reply.

To the Editor of the Scientific American:

I take great pleasure in giving your correspondent the benefit of a protracted investigation of pin worms, which resulted in their complete and permanent extermination in the case in which I was immediately interested.

Like all the myriad parasites which afflict humanity, the pin worm probably came to man by migration from some of his poorer relations of the strictly animal world; it is not reasonable to suppose that Adam had them all.

It is commonly held that transmission is now made by the mouth, the eggs being taken in water or on infected food handled by persons afflicted with worms.

The eggs have been found under the finger nails of children and others troubled with pin worms. It is also on record that the worms have been found in the intestines of infants dead *in utero*, indicating either spontaneous generation or the circulation of the eggs in the blood of the mother.

The period of incubation is uncertain, probably three or four days, as it takes about a week for the intestinal tract to become infested after a thorough evacuation of its contents.

The belief that the worms inhabit the rectum only is a mistake. The breeding place of the pest is the cæcum, whence the worms descend or are involuntarily carried to the lower bowels and rectum. For this reason ordinary injections and medicines taken by the mouth afford only temporary relief. To exterminate the pest they must be reached (and the females killed) in the cæcum, particularly in that portion not purged when the intestinal tract is cleared in the ordinary way.

The simplest means of killing the worms the writer discovered by experiment to be by their immersion in *pure water*. Used to the denser secretions of the intestinal tract, the worms absorb water by endosmosis until they burst. Hence the rational and effective remedy by drowning the pests with copious injections of tepid water after the intestinal tract has been thoroughly washed out, the injections being ample enough to surely flood the cæcum.

The injection should be made while the patient is lying on the back; perhaps most comfortably and effectively while lying in the bath. It is best not to depend upon a single irrigation of the cæcum, as some worms may escape in folds of the lining, or eggs enough may be left to perpetuate the pest. A second flooding should be resorted to in three or four days, and to make assurance doubly sure, the flooding may be repeated once a week for several weeks. With patience and care a perfect and permanent cure can be effected. If your correspondent's physician finds nothing to render the treatment suggested inadvisable in his case, he can count on certain and immediate relief. Respectfully,

EXPERIENCE.

Worms 300 Feet Under Ground.

The Gold Hill (Nevada) *News* reports the discovery of a queer species of worms in the face of the Lord Lorne mine, near Lower Gold Hill. The worms occur in a solid stratum of stiff clay, 700 feet from the mouth of the tunnel, and 300 feet below the surface of the earth, amid the vein matter of that portion of the Comstock. Superintendent McDougal found quite a number of them by soaking and washing the clay, and they are no defunct relics of antediluvian times, but are all alive and kicking, incredible as it may appear. These queer little subterranean worms are about three-quarters of an inch long by about an eighth of an inch in diameter, short and thick, resembling some species of grub. Each is incased in a very neat little shell of silicious material, corrugated and firm, of a bluish cast, like silver ore, with small round spots, having a metallic luster. At his forward end appears a vicious-looking little head, and six legs or feelers capable of being easily folded when he draws back into his shell. On top of his head is a small helmet or cover, of the same material as the shell, so that when he hauls in for a snooze or self-protection his top-piece or helmet just closes the hole nicely. Why this hard shell covering or protective armor, or how it is that these very peculiar worms are found alive at such a depth in virgin ground, is not easy of explanation. Their presence can be accounted for on the score of some deep crack or disturbance of the earth at some time, yet what they are doing there and what supports them is a mystery, for the clay is no way rich, though it is wormy. They certainly are a great natural curiosity.

AGRICULTURAL INVENTIONS.

Messrs. August W. Brenner and James Fraser, of Coleman, Texas, have patented an improvement in cultivators for cultivating stubble, sugar cane, cotton, corn, and other plants planted in rows or drills, which will remove the soil from the sides of the rows without injuring the roots, and will throw soil around the plants.

Mr. Nelson Dulaney, of Lynnville, Ill., has patented a sulky cultivator, so constructed that the plows can be readily adjusted to throw the soil toward or from the plants, and so that the inner plows can be guided along crooked rows to avoid irregular hills.

Cure for Sea-Sickness.

As "all the world and his wife" seem to be going to Europe this summer, sea-sickness and its cure is one of the most general if not the most popular topics for talk. Three New York doctors were recently interviewed upon the subject. The Brooklyn *Eagle* thus summarizes their opinion. One said there is only one one remedy for it—to stay ashore. But he subsequently admitted that that is not a complete remedy, for he added that land-sickness, caused by riding backward and in railway cars, is the same as sea-sickness. But another doctor, Dr. George M. Beard, says that within a year there is no disease about which so much has been learned, and which is so perfectly curable. It is a disease of the nervous system, mainly of the brain and spinal cord, comes from a series of mild concussions, and produces, by sympathy, disorder of the stomach. The remedy is bromide of sodium, taken three times a day a few days before embarking, and kept up at sea until the danger is passed. It renders the system less susceptible to the disturbances caused by the movements of the ship. The drug must be taken intelligently and on consultation with a physician. Dr. Hammond says that in his own case he has found ten or fifteen drops of chloroform on lump sugar and the use of bromide of potassium beneficial. All three doctors agreed that there is no benefit to be derived from sea-sickness except for those who are in the habit of eating too much. And if people are "the better for it," it is because the sea makes them better in spite of sea-sickness. "No more benefit can be derived from it than from an attack of typhoid fever," says Dr. Beard. If, therefore, it can be prevented without causing any other or any greater harm to the system, people are entitled to the full benefit of remedies that are really such.

The Registration of Plumbers.

A bill for the registration of plumbers and the supervision of all plumbing work by the Health Departments of New York and Brooklyn has been passed by the Legislature at Albany and approved by the Governor. The law with regard to registration will go into effect next March; the more important provisions take effect immediately.

The following rules, drawn up by the New York Board of Health, after consultation with intelligent plumbers and sanitary engineers, will probably be substantially adopted under the new law:

"When the [plumbing] work is completed and before it is covered from view the Board of Health is to be notified, that it may send inspectors, upon whose report the board will act upon its final approval.

"All materials to be of good quality and free from defects; the work to be executed in a thorough and proper manner.

"All the plumbing in the house so placed as to be readily inspected.

"Every soil-pipe and waste-pipe of iron, and extending through and at least two feet above the roof, of undiminished size.

"No traps on vertical soil-pipes or vertical waste-pipes.

"The house drain of iron, with a fall of at least half an inch to the foot, and provided with a proper trap near the street, and with an inlet for fresh air just inside the trap. It should run along the cellar wall, and never be hidden under ground.

"These iron pipes to be sound, free from holes, and of a uniform thickness of not less than one eighth of an inch for a diameter of two, three, or four inches, or five thirty-seconds of an inch for a diameter of five or six inches. Before they are connected they should be thoroughly coated inside and outside with coal-tar pitch, applied hot, or with some other equivalent substance.

"All joints in the soil-pipes and waste-pipes so calked with lead, or with cement made of iron filings and sal ammoniac, as to make them impermeable to gases.

"When lead pipe or trap is connected with an iron pipe, the joint should be made through a metallic sleeve or ferrule, and calked with lead.

"Every sink, every basin, every watercloset, and every tub or set of tubs separately and properly trapped.

"All traps ventilated by a special pipe extending above the roof.

"Every 'safe' under a basin, refrigerator, or other fixture, drained by a special pipe not directly connected with any waste-pipe, drain, or sewer.

"Every watercloset supplied with water from a special cistern, and not by direct connection with the Croton supply.

"No overflow pipe from a cistern to be directly connected with any soil-pipe, waste-pipe, or drain.

"When the pressure of the Croton is not sufficient to supply the cistern a pump should be provided.

"No cistern for drinking water to be lined with lead."

THE PROSPECTS AND PRESENT STATE OF PHOTOGRAPHY IN NATURAL COLORS.

IN TWO CHAPTERS.

I.

From the fact that the production of photographs in natural colors has twice within the past few weeks been brought forward with some degree of prominence, once at a meeting of the Polytechnic Section of the American Institute, and also at the last meeting of the Association of Operative Photographers of New York, a brief glance at the nature, modes, and prospects of heliochromy may be useful. Already photographs are taken on plates prepared by modern processes possessing such sensitiveness as to enable one to depict the action of the horse's foot in trotting, or, as was shown at the recent fair of the above institute, the swift steamboat arrested as it dashes at full speed across the line of vision of the camera. It only now remains that the splendid discovery of photography be crowned by the further discovery of the means of obtaining pictures possessing all the colors of nature, and by means so simple and certain as to be within the compass of the powers of the average operator.

The fact that several wise men, who have been imperfectly acquainted with the subject, have shaken their heads at the idea of its being possible to produce photographs having the colors of nature, need not greatly distress the experimentalist. What scathing contempt was hurled by the College of Physicians at the head of the discoverer of the circulation of the blood when he announced the fact! With what keen point did the far-seeing Sir Walter Scott ridicule the idea of a street being lighted by gas! Who is unaware of the pity expressed for the mental condition of those who proposed ocean steam navigation, communication by telegraph, and indeed nearly every startling advance in the applications of science? Even the unreasoning bigotry displayed by the British Parliament when George Stephenson advocated railway traveling by steam, was insufficient to prevent his gifted son, Robert Stephenson, from ridiculing the French project of the now accomplished Suez Canal; while in the science of photography the late Sir David Brewster often declared the impossibility of producing an accurate photograph unless by a lens the size of that of the human eye. The true investigator, while not ignoring past experience, must march beyond it.

It is a fact, to which some of the earlier volumes of the SCIENTIFIC AMERICAN bear attestation, that photographs bearing the colors of nature have been taken, and this not by a happy accident, but by design. The beaten tracks in photographic chemical routine must be departed from to secure an end, in the accomplishment of which certain well accredited laws of physical science are overridden; for, as was remarked by a speaker at one of the meetings alluded to, heliochromic chemistry recognizes an entire change in the relative activity of the various colors of the spectrum. Blue or violet light, which in ordinary photography is synonymous with white in its actinic power, here acts in the most laggard manner, while the comparatively non-chemical red light, which produces so little change upon the sensitive plates in common use, here acts in the most energetic manner.

Two objections may reasonably be urged against such examples of heliochromy as up to the present time have been produced: It is an exceedingly difficult matter to fix the colors when once obtained; and when so fixed the colors are sadly deficient in beauty and brilliancy. True, they are sufficiently pronounced to render it easy to distinguish the colors from each other, but they are yet far from being able to satisfy the requirements of a utilitarian age. Their production is a scientific, but not yet a commercial fact. Owing, perhaps, to some imaginary innate difficulty in the operations, or possibly to a want of faith in ultimate success, the laborers in this field are indeed few, the progress being commensurate. The whole superstructure of heliochromy rests as yet upon the foundations laid in 1839 by the late Sir John Herschel, who observed that paper sensitized by chloride of silver and darkened by exposure to light was then in a condition to reproduce certain colors when again exposed to the action of light under pieces of glass of various colors. From his experiments he was led to declare his belief that photography in natural colors might reasonably be expected to be brought within the range of accomplishment.

For the guidance of those readers who may feel desirous of instituting researches in this direction, we shall give out lines of the most successful methods by which experimentalists have worked. A polished plate of silvered copper, as used for daguerreotype, is immersed in a mixture of one part of sulphate of copper, two parts of common salt, and five of water, three ounces of which, together with a like quantity of a saturated solution of common salt, are diluted with eighteen ounces of water. It will be perceived that bichloride of copper and sulphate of soda are formed by the mixture of these substances. Into this bath the plate when immersed is rapidly coated with a violet subchloride, and this, after washing and drying, is all the preparation the plate requires to enable it to receive the colors of nature. Another method of preparing silvered plates consists in attaching one to the positive pole of a galvanic battery, a piece of platinum foil to the negative pole, and then immersing in greatly diluted muriatic acid. In the course of a minute it will pass through several stages of coloration, including yellow, blue, green, rose, and violet, at which last it must be removed, washed, dried, and heated slightly till it becomes a red color. It is now sensitive, and becomes readily impressed with all the colors. There is reason for believing, although such fact has never been published, that by this method were prepared the plates upon which Becquerel produced his famous photographs of the spectrum showing the colors. When paper or glass plates are employed instead of the silvered copper the methods by which they are prepared are analogous to those described, at least in principle. A sheet of subchlorized paper having been floated upon a solution of bichromate of potash, chloride of potassium, and sulphate of copper, and then dried in a darkened room, is now ready for exposure. In one experiment made it required an exposure under a painted magic lantern slide for a quarter of an hour to print the colors, on which occasion it was noticeable how much sooner the reds printed than the blues. Modifications of this method of preparing paper, involving the employment of nitrate of mercury, with the subsequent use of chlorate of potash and dilute sulphuric acid, have yielded paper so sensitive as to receive impressions in less than a minute. When glass or porcelain are used instead of paper, a film of collodion should be the medium in which to form the sensitive subchloride of silver, a process now easy of accomplishment.

When making some experiments under the direction of M. Chevreul, M. Niepce de St. Victor, who tried his heliochromic experiments on a large doll bedecked with jewels and resplendent with colored silk, made the remarkable discovery that black is not the mere absence of light, but is entitled to be considered a color of itself, and has a special chemical action of its own. The color of the sensitive plate was violet, and on this the camera impressed all the colors of the doll, including white; but, as the blacks had also been impressed *as* black, it led to this experiment: A hollow tube, black from the absence of light, was presented to the camera, together with another article of a definite black color, with this result, that the former was represented by an unaltered state of the original violet color of the surface, while in the latter case a very deep black resulted. The philosophy of or deductions from this singular discovery do not now claim our attention.

If the present state of photography in colors by natural or chemical means is unsatisfactory, not so is that by artificial pigments, applied, however, by the agency of light itself. This phase of heliochromy will be treated in another article.

Completion of the Eddystone Lighthouse.

Within another month or so—much earlier than was originally anticipated—the actual building of the new Eddystone Lighthouse, so far as the masonry is concerned, will be completed, and the work of furnishing it with the lighting apparatus will then speedily begin. The whole of the stonework of the lighthouse is in fact not merely constructed, but in the hands of the actual builders, whose work consists in conveying the already prepared blocks to the reef, and fitting them in their places there. The contract for the provision of the stone for the construction of the lighthouse was, it will be remembered, taken by Messrs. Hugh Shearer & Co., of 21 Great George street, Westminster, the owners of the De Lank granite quarries near Wadebridge, and of granite quarrying rights away to Rough Tor, over an area of something like twenty square miles. The stones have been wrought in a yard at Wadebridge, where every one of 2,200 of which the lighthouse is composed—they weigh in all 6,000 tons—has been brought to the precise dimensions required and fitted to a hair's breadth, the whole of the structure being built up section by section preparatory to its shipment. This work has now been brought to a close by Messrs. Shearer & Co. six months before the expiration of the time allotted in their contract, and the last stone of the outward curve of the top gallery was dropped into its place in the presence of Mr. Douglass, the engineer of the work, who heartily congratulated Mr. Shearer upon the style in which the contract had been executed.

The completion of the work by the present date is a matter of great importance, as it saves very much more time in the erection than the six months gained on the contract, in consequence of the early period of the season, which will enable the fitting of the lantern, and is to be proceeded with almost at once. The lighthouses of the Great and Little Basses, Ceylon—executed at the Dalbeattie granite quarries of Messrs. Shearer, Field & Co.—were also carried out much to the satisfaction of all concerned, as in the present instance well within the time named in the contract. The stones for the Eddystone have, of course, varied somewhat in size, but those of the base may be cited as fair examples, and they are each 6 feet 6 inches deep, 2 feet thick, and 3 feet 10 inches on their outer circumference.—*Building News.*

Important Photographic Discovery.

At the meeting of the Photographic Society of Great Britain, London, May 10, Mr. Warnerke proceeded to give the details of a new discovery he had made respecting the action of pyrogallic acid on gelatino-bromide. This discovery consisted in the fact that a gelatine plate submitted to pyrogallic acid became insoluble in those parts acted upon by light, exactly in the same way as gelatine acted upon by chrome salts, the insolubility being in proportion to the amount of light and the thickness of the gelatine. This property Mr. Warnerke proposes to utilize in various ways. The drawback in the ordinary gelatine process being that, unless the exposure is very accurately timed, there is considerable danger of overexposure, and intensification being very difficult, pictures by the gelatine process are often inferior to those by collodion. By the new process he was, however, able not only to intensify, but also to overcome the drawbacks arising from overexposure. The latter he effected by using the emulsion on paper. He had found that no matter how much the paper was overexposed, the picture, provided the developer was restrained sufficiently, was not injured, while in the case of the emulsion on glass, there was not only halation of the image, but a reversal also. The transfer of the image from paper on to the glass is very easy. The paper is immersed in water, and placed in contact with a glass plate. The superfluous moisture being removed by a squeegee, the paper may then be stripped off, leaving the gelatine on the glass. Hot water is then applied, which dissolves all the gelatine not acted on by light, and the image is left upon the glass in relief. Intensification Mr. Warnerke effected by mixing with the emulsion a non-actinic coloring matter, and which is not affected by silver. Aniline colors he had found answered the purpose, and in this way special emulsion for special purposes could be prepared. This method of preparation he thought would be especially suitable for magic lantern slides. Mr. Warnerke claimed that by his discovery relief could be obtained far more easily than by the ordinary bichromatized gelatine, and therefore it was especially suitable for the Woodburytype process. By mixing emery powder with the emulsion it was rendered fit for engraving purposes, and by a combination with vitrified colors the image could be burnt in, and being so adapted for enamels. By using a suitable emulsion, however, so little gelatine could be employed as to obviate all difficulty in carbonizing. The process could also be adapted for collotype printing.

In the course of his remarks, Mr. Warnerke demonstrated the removal of a gelatine picture produced by his method from paper to glass, and showed that the mere immersion and washing in hot water fixed the picture by the dissolving of the gelatine unacted upon by light, which thus carried away the unchanged bromide of silver.

In conclusion, Mr. Warnerke stated that the sensitive paper could be used in the camera in lengths, wound on rollers, and exhibited a slide which he had made for the purpose.

MISCELLANEOUS INVENTIONS.

An improved ice house door fastener has been patented by Mr. Francis Keil, of New York city. The invention consists in a novel combination of latching and locking mechanism, and the combination therewith of mechanism for wedging the door to its seat.

An improved gate, which can be conveniently opened from a vehicle, has been patented by Mr. Henry Salisbury, of Newburg, N. Y. The gate consists of a series of horizontal rails or slats pivoted to end uprights, the inner one of which is hinged to a post, and has a beam pivoted to its upper end, the outer end of which beam is connected with the outer end of the gate by a pivoted rod, and the inner end of this beam is provided with a weighted roller and suitable stops, so that when a rope is pulled the latches will be raised, the inner end of the beam will be raised, and the weighted pulley will roll to the end of the beam, thereby raising the outer end of the gate, which can be swung open by pulling on the rope.

A simple, inexpensive, and efficient reflector, which may be readily applied to ordinary lamps or lanterns, and as readily detached when not desired, has been patented by Mr. Henry E. Haley, of Monroe, Me.

Mr. Henry W. Mattick, of Lawrenceburg, Ind., has patented a composition for filling the pores of wood, consisting of gum shellac cut in alcohol, kauri gum, spirits of turpentine, drying oil, raw linseed oil, and red lead.

An improved bail fastener, patented by Mr. John A. Marston, of Centre Sandwich, N. H., consists in combining with a splint basket and bail a metallic strip clasped about the bail, and having both ends then passed between two splints and bent divergently over them.

An improved corset has been patented by Imogene E. Banker, of Brooklyn, N. Y. The object of this invention is to furnish corsets that will give proper shape and can be worn without discomfort, and to dispense with paddings and other devices used to give form to ill-shaped persons.

Neckties and scarfs, as usually worn, are pinned to the collar, so as to be retained in place. Mr. Myer Hellman, of New York city, has patented an improved device, which is a substitute for pins for accomplishing the same object, and has the additional advantage of being more convenient in use, always at hand, and allowing adjustment after the collar and neckwear are put on the person.

A head rest, which can be folded compactly for transportation, and can be erected in a short time, has been patented by Mr. Heinrich Strauss, of Nüremberg, Germany. The head rest is formed of a sheet or piece of fabric attached to a frame, which is so constructed that the sheet is held inclined, and its tension can be regulated at will.

An improved tool for handling, opening, closing, and scraping boxes, barrels, bales, etc., has been patented by Mr. William H. Bickelhaupt, of New York city. The invention consists in a hook attached to a transverse handle, with a hammer head at one end and a claw at the other end, the hook being provided with a scraping knife projecting in the opposite direction of the hook.

Mr. Jean Escoubés, of New York city, has patented an improved shutter bower, in which a curved bar is used in combination with a catch.

An improvement in end gates for wagons has been patented by Mr. Matthew F. Allen, of Nashville, Tenn. The object of this invention is to facilitate removing the end gate of wagons for the purpose of discharging the load without removing either of the body rods. It consists in an end gate provided at one end with a sliding piece pressed outward by suitable springs, and provided with a hasp or handle, by means of which it can be withdrawn from between two cleats of the side of the wagon, so that the end gate is shortened sufficiently to be withdrawn from between the sides of the wagon.

An improvement in sewing machines has been patented by Messrs. William G. Wilson, George S. Darling, and Henry Wulff, of Chicago, Ill., assignors to Wilson Sewing Machine Company, of same place. The improvement relates to sewing machines of the class using oscillating shuttles; and it consists in certain novel features of construction that cannot be clearly described without engravings.

An improved mechanical movement has been patented by Mr. Joseph Harris, Jr., of Boston, Mass. This invention is an improvement upon the machine for changing a reciprocating into a rotary motion, described in letters patent numbered 7,902, which were granted to the same inventor January 14, 1851.

An improved spindle and bolster, in which the spindle is firmly supported, and, with its attached whirl, can be conveniently detached from the bolster when required, has been patented by Messrs. Joseph Duffy and Henry Whorwell, of Paterson, N. J. The spindle is constructed with oil chambers that facilitate the lubrication of the spindle bearings.

An improved machine for revolving cans in solder has been patented by Mr. David Klump, of Moorestown, N. J. The invention consists in a ring provided with set screws for securing it to a fire pot, and also provided with a slotted arm having the base plate of a perforated upright secured to it adjustably by a set screw, a standard secured adjustably in the perforated upright by a set screw, and having an adjustable collar clamped to its upper end, and a cylinder secured in the said collar and carrying a rotary shaft having arms attached to its forward end, and held forward by a spiral spring, so that the can will be revolved by rotating the shaft.

A glove fastener, which is durable and effective, and does not tear the glove, has been patented by Mr. Joseph Whitby, of Yeovil, County of Somerset, England. The invention consists in a hollow stud containing a spring which projects through slots in the sides of the stud and catches on a shoulder of an eyelet as the stud is passed through or into the eyelet, thus locking the two together, the eyelet and stud being fastened to the opposite lapels of the glove.

An improvement in stoves has been patented by Mr. William Clark, of Troy, N. Y. The object of this invention is to improve the construction of the stoves for which Letters Patent No. 122,156 were issued to the same inventor December 26, 1871, to adapt it for burning bituminous coal, and to allow the ashes to be more effectually shaken out of the fire box. The invention consists in constructing the fire box with offsets in the upper parts of its sides, and the case with openings provided with dampers in the upper parts of its sides through which air can be admitted to the upper part of the fire box, to adapt the stove to burn bituminous coal.

Mr. David Untermeyer, of New York city, has patented a finger ring so constructed that the shank can be detached from the heads and replaced with a larger or smaller shank

An improved vehicle wheel has been patented by Messrs. Charles W. Ball and Thomas Davis, of Macon, Ill. The invention consists in combining with the spokes of a wheel, a tire and metallic felly, forming a T-bar, and spoke sockets arranged on both sides of the felly, whereby strength and durability are secured to the wheel.

An improved gate latch has been patented by Mr. Albert L. Grayson, of Rutherfordton, N. C. It consists of a wire or rod of iron bent into a square loop, one end of the rod being extended to pass through the gate and have a knob or other means of turning or swinging the loop for unlocking the gate secured to it, the loop being adapted to catch over a triangular projection or keeper secured to the gate post.

A fireplace which will cause complete, or nearly complete, combustion of the gases and smoke produced by the burning fuel, and at the same time radiate the heat in a downward direction to heat the lower stratum of air, has been patented by Mr. Gerard R. Ricketts, of Quaker Bottom, O. The invention consists in an inclined radiator having current or gas arresters or deflectors on its front face, one of which may have a suitable draught passage.

Mr. William Taylor, of Chicago, Ill., has patented a device by which mops may be easily and conveniently wrung. The invention consists, principally, of two metal skeleton frames hinged together, each carrying a roller, one of the frames being curved to fit the bottom and the edge of the bucket or tub.

Mr. George C. De Lametter, of North Wolcott, N. Y., has patented an improved apparatus for drying fruit, the object of the invention being to obtain sufficient draught of heated air without the use of a blower, and to prevent the fruit on the upper trays from being sweated by the damp air rising from below.

An improved millstone sharpener has been patented by Mr. Patrick Graham, of Stockholm, Sweden. The invention consists of one or more toothed disks mounted upon or forming part of a radial arm connected with the driving spindle, to adapt the sharpener to break or sharpen the grinding surface of a millstone by being moved over the surface under pressure.

A cheap, durable, and efficient trace holder for harnesses, one which will hold the cockeyes in any position on the harness, and one with which the cockeyes may be engaged and disengaged without trouble, has been patented by Mr. Volney Stepp, of Manhattan, Kan.

Mr. Philip Thorpe, of New York city, has patented an improved pneumatic refuse-conveyer, whereby the refuse of the dwellings and the sweepings of the streets of cities may be deposited into proper receptacles and released therefrom into underground pipes, to be conveyed therein by pneumatic pressure to any desired discharging point.

A cultivator which shall be adapted for cultivating different kinds of grain, and for use upon stony or stumpy ground, has been patented by Mr. Clinton Mendenhall, of Martinsburg, W. Va. The invention consists in a wheeled frame having lugs and inclines on its forward end, and a system of levers and shafts, by means of which the plows may be lifted out of the ground.

Mr. Francis B. Snodgrass, of Harrisville, W. Va., has patented an improved root-cutting plow, so constructed as to rise and pass over obstructions that cannot be cut, and which will allow the colter to be adjusted and reversed.

An improved friction brake has been patented by Mr. Abraham O. Frick, of Waynesborough, Pa. This invention relates to improvements upon that form of friction brake in which two segmental sections or shoes are made to bear against the opposite sides of the periphery of a wheel to arrest the movement of the latter.

Mr. Napoleon Prince, of St. Boniface, Manitoba, Canada, has patented a windmill, so constructed that it can be adjusted to run at any desired speed and in either direction, which will adjust itself, as the force of the wind varies, so as to run at a uniform speed. It can be readily thrown out of the wind and can be instantly stopped.

The Engineer's Inspector.

In rolling mills and constructive ironworks a familiar and well-recognized personage is the engineer's inspector, whose duty it is, or ought to be, to test the manufactured iron, to inspect the quality of material and workmanship throughout its various stages during its progress of manufacture toward completion, and to insure their reaching the standard of perfection required. He is considered the *bete noir* of contractors, who are obliged, from policy, to hold the candle to him, and to adopt all kinds of ingenious devices to keep themselves in his good books and favor. There are inspectors and inspectors, in the same way that there are contract specifications and specifications. The *Design and Work*, London, thus classifies these personages: We have the gentlemanly inspector, whose object and pleasure it is to assist the contractor in carrying out the work intrusted to him in accordance with the common-sense terms of a fair specification. These gentlemen it is a pleasure to have about a works. They practically save the contractor the cost of an additional foreman, overlooker, or leading workman. Again, we have other inspectors, who are certainly not gentlemen in any sense of the term, whose only aim and effort appears to be to give the contractor as much trouble as possible, who continually interfere in every petty detail, and generally, as they say, have their pound of flesh. These men would have the contractor remodel and rearrange his works to suit their ideas and convenience—no two inspectors probably agreeing in their requirements, they would have the various operations and processes performed at a different time or place to that in which the establishment had been accustomed. This class of inspectors gives rise to great annoyance among contractors, and arouses a great amount of ill-temper in the workmen, who sometimes are irritated so far as to rebel and refuse to work under their inspection. When two or three of this type get together over their beer and tobacco, they laugh, chuckle, and relate anecdotes of how they have *done* this contractor, and made another one pull so much of the work to pieces as would satisfy their own sweet will—in fact, they appear to glory in the annoyance they cause.

If any of the foremen or higher officials belonging to the works offend one of this class, woe betide the unfortunate contractor. They revenge themselves upon the unoffending iron. More test pieces must be cut from the largest plates and longest angle and T-bars. Everything is rejected or objected to, if by any manner a pair of spectacles or a microscope can be found to reveal a flaw. Kirkaldy's chamber of horrors (museum of fractures, as it is euphemistically called) is invoked—and you may be sure that this inspector will have his pound of flesh, if man ever had it. The contractor may use strong language, sigh, or groan, to no effect, as the specification has him in a net, when it says, as is usually the case, that the work is to be done to the satisfaction of the engineer or his deputy.

Another class of inspectors may be termed the nervous class. These are perhaps more to be pitied than blamed, but they are perhaps more aggravating than any others. They cannot make their minds up whether a piece of work is good enough for them or not, so they keep pecking at it, first having one part pulled to pieces, and then another, until the whole is reduced to its original state of raw material; and then, perhaps Mr. Inspector adds at the last: "Ah, I think it would have done, after all!"

Another class is that of the thirsty inspectors. These are always in a state of chronic thirst, and continually throwing out hints that "this is a dry shop," or that "it is very hot to-day." They expect to be treated on every possible occasion, and of course, as it is in the power of the inspectors to hinder the execution of work, and cause the contractor extra expense, a system of judicious bribery is adopted toward them. In some works a small cellaret is kept stocked in the inspector's office with his choice liquor. In other cases constant adjournment is made to the nearest public-house or hotel, where the proprietor or his deputy gives him a "skinful," a tough old drinker being told off for his companion. In high-class works a butler is kept, and the inspector is dined *en règle*. In other works a kind of table d'hote is served for the chief officials, to which Mr. Inspector is invited, and it is curious to notice his visits are timed about meal times—he accidentally drops in just about lunch or dinner time. If late, he comes into the office with "Good morning," "How do you do?" "Oh, I am as hungry as a horse!" Or it is, "I have lunched, but I have had no whisky." To which the proprietor responds by calling John to take Mr. Inspector over the way to lunch.

Some inspectors require more positive bribery even than food and drink, and various devices are resorted to to find out the particular sum that is sufficient for the purpose. Numerous anecdotes, real and apocryphal, are current in many works. Thus we have an inspector finding fault with the work, when the manager comes up, and the conversation takes this line: The manager says: "I suppose if I were to put a sovereign over each of your eyes you could not see this?" To which the inspector replies: "No, I could not see it; and if you were to put another over my mouth, I could not speak about it." Another instance: The proprietor says to the inspector: "I say, do you think £200 would plane those edges and joints?" To which is replied: "I dare say it would." "Well, it's yours if you plane them." "All right," says the inspector. It is needless to say the joints and edges were never planed.

A continuous system of judicious bribery enables this class of inspector to save money enough to retire comfortably in old age. Many German and French firms, with their usual minute accuracy, include in their estimates definite sums for dinners and presents to the engineers and inspectors, but English firms leave these charges to go in with the working expenses. It is a difficult thing to know exactly where to draw the line between ordinary politeness and hospitality and deliberate bribery.

Another type of inspector is the occasional inspector, who is generally a pupil of the engineer. This young gentleman looks as if he had just come out of a bandbox. He is got up in lavender kid gloves, eyeglass, and clothes of the latest fashion; he comes down to the works in style; there is no getting over him, in his estimation, although, to judge from appearances, his knowledge of iron and steel is of a very remote character. He may have heard or read of such things, but it is questionable whether he has seen them often enough to recognize them without explanation. This type of inspector gives rise to much amusement, and affords scope for practical jokes and hoaxes of the "verdant green" style.

Many inspectors cannot trust a contractor or any of his workmen an inch further than he can see them. He will have the plates and bars cut out of the work itself, or have the test bars of castings out of the same ladle, and even in extreme cases will insist on the test bars being cast bodily on to the particular casting under inspection.

As a general rule the lower the status of the inspector the more troublesome is he to the contractor. The engineer, if the designer of a structure is satisfied with a plain, good, substantial job, will not object to the alteration of a section of iron, provided there is no loss of strength, nor will he object to small defects; but the small inspector is either too nervous, too particular, or too consequential to consent to any such deviation from the drawings and specifications as this. We are inclined to think that work is much overinspected at the present time, and very much question whether work has improved in quality in comparison with the increase of inspection. We don't think many great improvements have come from inspectors in the manufacture of iron and steel. We may point to two great examples in bridge structures—the Menai Tubular Bridge and the ill-fated Tay Bridge. The first was erected before the days of rigid inspection and engineering vagaries, the last was built when the modern system was in full bloom. We may remark that no amount of inspection will compensate for errors in design. We are not advocating the abolition of the inspector, but the judicious use of him, and careful selection of men for the office. Contractors before tendering for work always want to know who the inspector is, what sort of a man he is, and to gather some information about the inspection, as so much depends upon the individual that it constitutes to them a serious item—in fact, it is a question of profit and loss.

There is too frequently a species of unfairness about the drawing up of specifications and the interpretation of their clauses by the inspector. Looking at the other side of the question, the inspector is placed in a very difficult position. He stands between two stools. He has to do his duty to his superior officer, to see the work carried out with efficiency and correctness, and yet retain a character for amiability. Some contractors take a delight in irritating an inspector in every possible manner; and if he recriminates, they at once cry out, He is disagreeable, overstrict, unfair, etc.

The inspector is the outcome of the present age of commercial activity, and as such, concludes *Design and Work*, we have given him a place in our portrait gallery of working hands and working heads.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Full Set United States Patent Office Reports, 1790 to 1871, for sale cheap; also duplicate volumes previous to 1849. George M. Elliott, Lowell, Mass.

Houghton's Boiler Compound contains nothing that can injure the iron, but it will remove scale and prevent its formation. Houghton & Co., 15 Hudson St., N. Y.

Callow's Lettering Pat., illus. p. 358. Catalogue free.

Persons having Patented Specialties they want placed on the market, address "Agency," P.O.Box 985, Prov., R.I.

Ladies can improve the appearance of their feet by using German Corn Remover. 25 cts. Sold by druggists.

Save cost of fuel and water, repairs, explosion, burning foaming, compounds, delays, cleaning, and all other evils of impure water, by using Hotchkiss' Automatic Mechanical Boiler Cleaner. 84 John St., N.Y. Circular free.

Beware of counterfeit; only one is genuine, and that is Van Bell's "Rye and Rock."

For Sale cheap.—2,000 candle power "Fuller" Electric Light Machine, complete with lamp and countershaft. Davis & Watts, Baltimore, Md.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Green River Drilling Machines. See ad. p. 396.

Corns can be pulled out by the roots in 4 days after applying German Corn Remover. 25 cts. Sold by druggists.

Propellers, 12 to 26 in. Geo. F. Shedd, Waltham, Mass.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

List 96.—Description of 2,500 new and second-hand Machines, now ready for distribution. Send stamp for the same. S. C. Forsaith & Co., Manchester, N. H.

Comoination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Tarred Roofing and Sheathing Felts. A. Wiskeman, Paterson, N. J.

Cope & Maxwell M'f'g Co.'s Pump adv., page 397.

Punching Presses & Shears for Metal-workers, Power Drill Presses, $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

Improved Skinner Portable Engines. Erie, Pa.

"Rival" Steam Pumps for Hot or Cold Water; $32 and upward. The John H. McGowan Co., Cincinnati, O.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 380.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

See Bentel, Margedant & Co.'s adv., page 412.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 561 Jefferson St., Philadelphia, Pa.

Gardiner's Pat. Belt Clamp. See illus. adv., p. 413.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

For Sequeira Water Meter, see adv. on page 364.

Clark Rubber Wheels adv. See page 380.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 381.

Safety Boilers. See Harrison Boiler Works adv., p. 381.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 381.

The Sweetland Chuck. See illus. adv., p. 396.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 397.

Steam Engines: Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 381.

Clark & Heald Machine Co. See adv., p. 413.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

Telegraph, Telephone, Elec. Light Supplies. See p. 413.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus. adv. p. 412.

Elevators, Freight and Passenger, Shafting, Pulleys and Hangers. L. S. Graves & Son, Rochester, N. Y.

For the manufacture of metallic shells, cups, ferrules, blanks, and any and all kinds of small press and stamped work in copper, brass, zinc, iron, or tin, address C. J. Godfrey & Son, Union City, Conn. The manufacture of small wares, notions, and novelties in the above line, a specialty. See advertisement on page 413.

Gear Wheels for Models (list free); Experimental Work, etc. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Gould & Eberhardt's Machinists' Tools. See adv., p. 414.

Blake's Patent Belt Studs. The strongest fastening for leather and rubber belts. Greene, Tweed & Co., N.Y.

Walrus Leather, Walrus Wheels, Pure Turkey Emery Star Glue for Polishers. Greene, Tweed & Co., N. Y.

The Medart Pat. Wrought Rim Pulley. See adv., p. 413.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 412.

For best Duplex Injector, see Jenks' adv., p. 413.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 414.

Drop Hammers, Power Shears, Punching Presses, Die Sinkers. The Pratt & Whitney Co., Hartford, Conn.

Catechism of the Locomotive. 625 pages, 250 engravings. The most accurate, complete, and easily understood book on the Locomotive. Price $2.50. Send for a catalogue of railroad books. The Railroad Gazette, 73 Broadway, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 414 Totten & Co., Pittsburg.

4 to 40 H. P. Steam Engines. See adv. p. 414.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) C. B. C. writes: I am about painting my brick house, and a friend suggests using what is called "Brilliant Stucco Whitewash," that it was very much cheaper than oil colors, and, if properly put on, would be as durable as oil colors. He said one end of the White House, Washington, was painted with it and had proved a success. A. The stucco whitewash (see answer to O. E. C., page 375 (40), last volume), when properly prepared and applied, answers very well for out-of-door brick and wood work, and has been used with satisfaction on the north wall of the White House. It does not cover old painted walls so well.

(2) J. A. M. writes: I have a carriage which is trimmed with blue cloth, or rather cloth which has been blue, but now it is much faded. How can I put on some color without taking the trimmings off? A. Dissolve completely 1 oz. good cotton blue (aniline blue 6 B) in alcohol 1 pint, mixed with warm water, 1 quart. Apply with a full brush quickly, so as to obtain a uniform color.

(3) D. A. writes: In your paper, the SCIENTIFIC AMERICAN of May 21, you state the large steam cylinder cast at the Morgan Iron Works was made of gun metal. Will you please inform me through your paper if it was made of brass gun metal or iron gun metal? A. Iron gun metal.

(4) P. N. asks: What is the best method of ventilating an ordinary country school house, the usual size of which is 24x18 feet, and 10 feet high? Suppose the number of pupils to be twenty-five or thirty, and the room to be heated either by wood or coal stove, is the outside pure air heavier than the warm carbonic acid inside the school room? If the warm carbonic acid inside (which settles at the bottom of the room) is lighter than the cold outside air, how can it be forced or got out of the room? If heavier, how can the outside air get in the room near the bottom? Does an ordinary stove remove much more carbonic acid gas than is created by the combustion of the fuel, this on the supposition that there is considerable carbonic acid in the room resulting from breathing, etc.? A. The plan employed in the United States Army Hospitals is perhaps the best, namely: Have (1) under the stove a large opening through the floor, connected by an air shaft (say two feet square) with the outside air (not cellar); 2, openings for the outlet of foul air both around the baseboards of the walls and also near the ceilings; the openings being provided with shutters so that the escape of foul air may be regulated as the weather may require from near the floor or near the ceiling.

(5) P. S. M. writes: I am about setting up a horizontal tubular boiler, 8 feet by 2 feet, to heat my house. Could I attach a magazine similar in principle to that used in base-burning, self-feeding stoves, which would supply coal to the fire during the night, thereby keeping up a more equable heat and requiring less frequent firing? If such a thing is practicable how can it best be accomplished? A. A magazine cannot be readily attached to a horizontal boiler, but vertical boilers have been made with a central magazine extending parallel with the flues and provided with a ring at the lower end projecting into the fire box. Such boilers give good satisfaction.

(6) A. H. C. writes: 1. I have a telephone line, two miles in length, upon which I use the Blake transmitter and bell telephone and telegraph instruments for calling. How can I make condensers so as to get rid of the resistance and induction in the telegraph instruments, and how shall I connect them? A. It cannot be done with the ordinary telephones. See Professor Dolbear's telephone in last issue of the SCIENTIFIC AMERICAN. 2. Please give me directions for making a Leclanche battery (new pattern). A. See SUPPLEMENT, No. 159.

(7) Student asks: What is the height above sea level of Mount Mitchell, Mount Clingmans, Roan Mountain, and Bald Mountain, all in North Carolina? A. The twelve highest peaks of Black Mountains, North Carolina: Clingman's Peak, 6,701; Balsam Cone (Guyot's Peak), 6,661; Sandox Knob, 6,612; Hairy Bear, 6,597; Cattail Peak, 6,595; Gibbs' Peak, 6,586; Mitchell's Peak, 6,576; Sugar Loaf, 6,401; Potato Top, 6,389; Black Knob, 6,377; Bowler's Pyramid, 6,345; Roan Mountain, 6,318.

English Patents Issued to Americans.

From May 27 to May 31, 1881, inclusive.

Electric wire supporter, W. C. Allison, Philadelphia, Pa.
Meter, fluid, B. Holly, Lockport, N. Y.
Musical instrument, C. G. Conn, Elkhart, Ind.
Ore crusher, H. H. Howland, San Francisco, Cal.
Railway signal, G. H. Roth, Boston, Mass.
Railway switch, W. T. Martin, Philadelphia, Pa.
Sewing machine, D. C. Smyth, Hartford, Conn.
Spring bed bottom, H. A. Dalrymple, Gardner, Mass.
Tricycle, J. A. McKenzie, Galesburg, Ill.
Weavers harness, Kendish Loom Harness Company, Providence, R. I.
Wire fabric, machine for making, W. C. Edge, Newark, N. J.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

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AND EACH BEARING THAT DATE

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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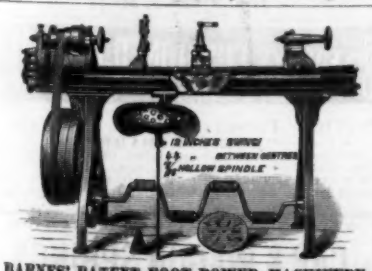

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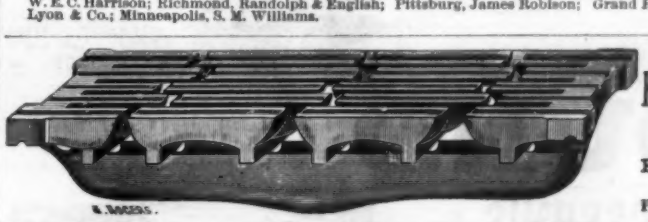

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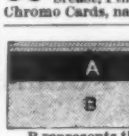

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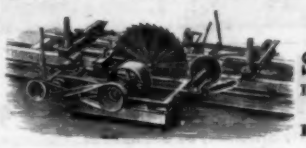

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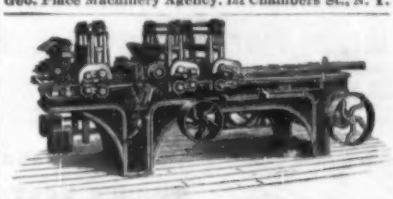

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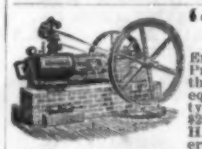

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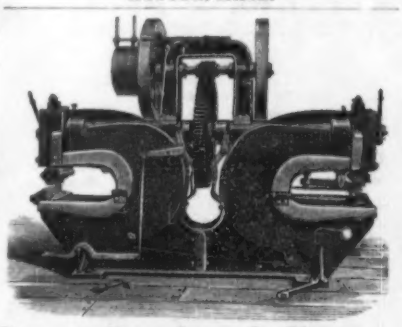

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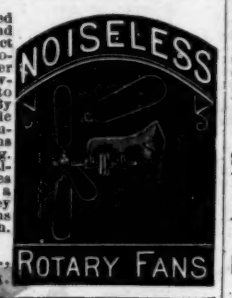

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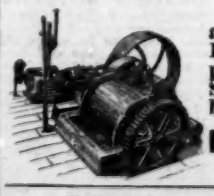
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